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ESTABLISHMENT REPORT AND PROGRESS REPORT

Reproduction Cutting Methods and Natural Regeneration of *Pinus montezumae* in Puebla, Mexico

by

James M. Guldin, Ph.D., USDA Forest Service, Southern Research Station
Raymond P. Guries, Ph.D., University of Wisconsin-Madison
Fernando Carrillo A., INIFAP/University of Wisconsin-Madison
Miguel Acosta M., INIFAP, Chapingo MEX

5 April 1996

Study funded by USDA Forest Service Washington Office
under 1994 USA-Mexico Research Letter of Intent

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Approved by:

4/5/96
(date)

James M. Guldin, LOI Study PI
Research Forest Ecologist, RWU-SO-4106
c/o Ouachita NF
P.O. Box 1270
Hot Springs AR 71902

ESTABLISHMENT REPORT AND PROGRESS REPORT

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EXECUTIVE SUMMARY

Reproduction Cutting Methods and Natural Regeneration of *Pinus montezumae* in Puebla, Mexico

James M. Guldin, Raymond P. Guries, Fernando Carrillo A., and Miguel Acosta M.

This is the establishment report and progress report for the study funded by the Washington Office of the USDA Forest Service under the 1994 USA-Mexico Research Letter of Intent. Study objectives are: 1/ to evaluate regeneration of Montezuma pine (*Pinus montezumae*) in mixed pine-hardwood forests using even-aged and uneven-aged reproduction cutting methods, and 2/ to evaluate site preparation and release treatments in mixed pine-hardwood stands. The study is currently in place, and treatments are to be imposed as this report is written.

The study is located at Campo Experimental (CE) San Juan Tetla (SJT) in Puebla, Mexico, INIFAP's principal research station for work with Montezuma pine. The study consists of eight square 4-ha treatment plots containing nested square 1-ha measurement plots. In the summer of 1995, a 100% inventory of all trees 20.0 cm and larger in the eight 1.0-ha plots quantified the pretreatment condition of the plots. Using the Southern Station's ecosystem management research sites in Arkansas as a guide, two replications of three treatments (one single-tree selection and two shelterwood) plus an uncut control treatment were assigned and marked at CE SJT. Trees are scheduled to be cut between February-April 1996.

Results to date include a phytosociological analysis of a typical CE SJT Montezuma pine stand. The quadratic mean diameter of Montezuma pine was 61.3 cm (24 in), and nearly 5 percent exceeded 90 cm (36 in) in diameter. Dominant Montezuma pines were approximately 35 m in height and 90 years old. In general, pines dominated the larger size classes, and hardwoods were most prominent in the smaller size classes. All in all, these are magnificent forest stands.

Conducting the marking allowed a test of accuracy when marking trees to leave rather than trees to cut. Marking trees to retain provided acceptable accuracy, especially in the uneven-aged stands. Absolute differences between target and final residual basal area for the treatment plots ranged from 0.80 to 4.82 m^2/ha with relative percentages of from 4.0 to 24.1 percent. The heavy shelterwoods exceeded the ten percent margin of error, due to the buffer basal areas being marked more like a moderate shelterwood treatment than a heavy shelterwood treatment.

Re-establishment of research plots will be made in the summer of 1996 following reproduction cutting. With current funding we expect to complete two projects that will comprise Carrillo's dissertation at the University of Wisconsin-Madison.

We anticipate three important outcomes in this study. First, the study will test innovative reproduction cutting methods for Montezuma pine. Second, the study will compare two different pine-dominated ecosystems in Arkansas and Puebla. Third, the act of bringing this study to fruition provides opportunities for future U.S.-Mexico collaborative efforts in forest research.

Reproduction cutting methods and natural regeneration of *Pinus montezumae* in Puebla, Mexico

James M. Guldin, Raymond P. Guries, Fernando Carrillo, and Miguel Acosta

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Reproduction cutting methods and natural regeneration of *Pinus montezumae* in Puebla, Mexico

James M. Guldin, Raymond P. Guries, Fernando Carrillo, and Miguel Acosta

INTRODUCTION

This document serves as the establishment report and progress report for the study funded by the Washington Office of the USDA Forest Service under the 1994 USA-Mexico Research Letter of Intent. The study is currently in place, and treatments are to be imposed as this report is written. This report provides the basis for distinguishing between pre-treatment and post-treatment conditions, and to report on progress to date.

This study was planned and carried out by four cooperating scientists from three research organizations, as follows:

1. Dr. Ray Guries, Department of Forestry, University of Wisconsin-Madison. Guries had the original idea for the development of this collaborative effort, and is the scientist responsible and best located for the overall design and conduct of the study. Guries supports the Wisconsin share of travel, equipment, supplies, and other arrangements for the work from private discretionary funding at the University of Wisconsin-Madison.

2. Dr. Jim Guldin, Southern Research Station, USDA Forest Service. Guldin was senior author of the proposal submitted to the Washington Office of the USDA Forest Service in FY94 in response to the 1994 USA-Mexico Research Letter of Intent, and for which $5,000 was granted in FY95. These funds support Guldin's involvment, other USDA FS involvement as needed, and the Forest Service share of the equipment and supplies.

3. Mr. Fernando Carrillo Anzures, research scientist with Instituto Nacional de Investigaciones Forestales y Agropecuarias (INIFAP), and Ph.D. candidate at the University

of Wisconsin-Madison. This study represents Carrillo's Ph.D. dissertation project, and Guries serves as Carrillo's major professor.

4. Mr. Miguel Acosta Mireles, INIFAP scientist, located at the INIFAP office in Chapingo MEX. Acosta serves as the scientist responsible for the arrangements and oversight of the study in Mexico.

We are unanimous in our assessment that the involvement of all three organizations is critical to the success of the study. The University provides the overall academic environment for the study. The USDA FS adds scientific expertise, subject-matter proficiency, and official coordination through the Washington Office. INIFAP brings additional scientific expertise, official coordination through the Mexican government, technical support and other in-kind services, as well as the study site itself.

OBJECTIVES

Background

Mexico contains some 50% of the world's pines (Styles 1993) with some authors enumerating more than 70 species indigenous to Mexico and central America (Martinez 1948, Perry 1991). The east-west axis of mountain peaks in central Mexico formed by the trans-Mexico volcanic belt creates a diverse topography paralleled by a rich flora; the states of Puebla, Mexico and Michoacan each contain more than 20 species of pines (Styles 1993). Collectively, pine and mixed coniferous forests account for two-thirds (21 million hectares) of Mexico's forested area and represent an enormous biological resource. In addition to their economic value for timber, fuelwood, resins, nuts and other products, these forests are also vital to the conservation of Mexico's rich biodiversity of plants and animals (Ramamoorthy and others 1993).

The pine forests of Mexico have been exploited for centuries, but recent increases in deforestation and conversion of land to other economic uses has led to concerns regarding the loss of pine forests and the genetic resources they contain (NRC 1991 App. B, Dvorak and Donahue 1992). Forest management practices, including silvicultural systems, are needed that provide for commodity extraction at a level that justifies local protection and supports local economies while still ensuring that non-commodity values are retained. Silviculturally, this translates to developing reproduction cutting methods that ensure successful regeneration of the desired species at a minimum cost.

Traditional silvicultural systems for pine forests of Mexico emphasize both even- and uneven-aged practices (Rodriguez and Rodriguez 1966, Rosales and others 1982). The seed tree system is widely employed to regenerate pine forests in Mexico with limited success (Jardel 1985). Single-tree selection has been used in Mexico with rather poor results primarily because the method is, in reality, 'high-grading'. In addition, intermediate stand treatments, especially control of mid-story hardwood competition, are seldom applied. Artificial regeneration is limited by low production of seedlings and poor seedling quality, but even large improvements here could not provide sufficient planting stock to meet regeneration needs. Present day pressures on Mexico's forest resources, and persistent problems in applying current silvicultural systems to pine forests in Mexico (Jardel 1985), suggest that these pine ecosystems are not sustainable. Thus, alternative silvicultural systems emphasizing natural regeneration can play a prominent role in maintaining Mexico's pine resources.

In 1991, the Southern Forest Experiment Station (now the Southern Research Station) of the USDA Forest Service began a three-phase program in Arkansas to evaluate natural reproduction cutting methods and 'non-traditional' silvicultural systems "...to establish and/or maintain stands comprised of mixtures of pines and hardwoods for the enhancement of multiple resource values" (Baker 1991). The silviculture component alone is a large and ambitious project; the current Phase II involves 11 reproduction cutting methods together with various site preparation and release treatments in 52 operational-scale stands of at least 35 acres (about 15 ha) each on the Ouachita National Forest and the Ozark National Forest (Baker 1991, Guldin and others 1993). This project involves scores of personnel, and it is not feasible to replicate this in Mexico. However, a subset of these treatments is feasible, with choice of treatments to focus upon those deemed most likely to secure pine regeneration while minimizing impact on other resources. Data from even a subset of treatments would be useful to the Forest Service as an indication of the applicability of ecosystem management practices in structurally similar but floristically different pine ecosystems. Values to INIFAP include opportunities to design and implement alternative silvicultural methods based upon current research in the U.S., as well as training of scientists in research methods and data analysis.

Although the species composition of Mexico's pine forests is different from that of the Ouachita Mountains of Arkansas, many forest regeneration problems appear similar between the two regions. One unifying feature involves the impact of hardwood competition which limits pine regeneration following harvesting. A failure to control hardwood competition typically leads to large increases in hardwood growing stock at the expense of pine. In Arkansas, Forest Service scientists are developing natural regeneration practices to establish and maintain mixed pine-hardwood forests; the maintenance of a hardwood component is desirable for aesthetic and biodiversity values important in the Ouachita Mountains. In Mexico, mixed pine-hardwood forests are viewed as inevitable, and maintenance of a hardwood component may be tolerable if it helps protect pine regeneration without creating intense competition. Protection of young seedlings from extreme microclimatic effects may favor some form of uneven-aged system, if applied in a technically riogorous manner. Thus, the questions of pine-hardwood reproduction cutting methods, residual stocking levels of pine and hardwood, changes in species composition and stand structures, and impacts on other biological resources are common to pine-dominated ecosystems in both Arkansas and Puebla.

Study Objectives

We have identified two objectives which represent a subset of the ecosystem management research objectives currently being examined in Arkansas. We recognize that not every important feature of ecosystem management can be included under these two silvicultural objectives, but additional research (such as wildlife and/or biodiversity concerns, nutrient cycling, water quality, or non-traditional forest products) can be considered in this study as future opportunities permit. Complementary research which parallels other ecosystem management goals will be welcomed.

Objective 1. Evaluate regeneration of Montezuma pine (*Pinus montezumae*) in mixed pine-hardwood forests using even-aged (shelterwood) and uneven-aged (single-tree selection) methods.

Overstory retention is important to create suitable microsites for germination and seedling survival, while control of competition and the light/shade environment is important for early growth. A principal consideration will be the degree of control needed for mid-story trees, especially hardwoods, to balance these competing needs.

Objective 2. Evaluate site preparation and early (intermediate) release treatments in mixed pine-hardwood stands to determine tolerable levels of hardwood competition while still achieving acceptable levels of pine regeneration.

Early release of seedlings from competition has been identified as a potentially critical stage in successful regeneration of *P. montezumae*, but this subject has not been explored (Musalem, 1984).

Two common tools used for release in the southern U.S. are prescribed fire and herbicides, and we are curious as to their applicability in Mexico. Although scientists in Mexico believe that *P. montezumae* is not fire-resistant, the species shares silvical characteristics in common with fire-adapted species such as longleaf pine (*P. palustris*)--for example, thick fire-resistant bark and a seedling grass stage. Regardless, experience with and techniques for use of prescribed fire in Mexico are poorly developed. In addition, chemical release is not considered economically viable in Mexico today.

Thus, a principal consideration will be to examine the timing and intensity of manual techniques needed to control competing vegetation while still providing a suitable microenvironment for seedling establishment.

METHODS

Study design and layout

Study area

The Campo Experimental (CE) San Juan Tetla (SJT) lies on the east slope of the Iztaccíhuatl volcano, in the municipality of Chiautzingo, Puebla. The research station is approximately 25 km southeast of the city of San Martin Texmelucan, Puebla, and is accessible by unpaved road. The station consists of approximately 1580 ha, and lies in an elevation zone of from 3000 to 3600 m (Boyas 1985, Acosta 1993).

San Juan Tetla remains INIFAP's principal research station for work with *P.montezumae*, one of Mexico's most important pines (Perry 1991). Mature trees attain heights of 25-35 m (50-80 cm dbh), occurring between 2,000-3,200 m elevation and reaching best development on the well-drained soils of volcanic slopes such as occur at San Juan Tetla. This station has been the scene of earlier research on soils (Rodriguez and Ortiz 1982), seed production and dispersal (Musalem 1984; Acosta 1986), site preparation and artificial regeneration (Carrillo 1986), provenance testing (Jasso 1990), wildlife surveys (Lemos and Amaya 1986), floral surveys (Boyas 1985) and related forest ecosystem research.

The stand used in this study is located approximately 1.5 km east of the station headquarters at CE San Juan Tetla. The stand is dominated by *P. montezumae*, with minor and varying proportions of three other conifer species--a white pine (*Pinus ayacahuite* var. *veitchii)*, a third occasional pine (*Pinus teocote)*, and a fir (*Abies religiosa)*. In addition, several species of hardwoods (hojosas) are present, including alder (*Alnus firmifolia)*, several willows (*Salix oxylepis* and other *Salix* sp.), and an oak (*Quercus laurina* according to Boyas (1985)). The understory is dense; it is dominated by small *Alnus* sp., *Quercus* sp., *Salix* sp., a lush growth of perennial and malodorous *Senecio* sp., and other herbaceous and shrub vegetation. In total, the understory is sufficiently dense to impede walking through the stand.

The stand lies at an elevation of approximately 3300 m. The aspect of the stand is generally to the east and south. Physiography is gently to moderately steep (10%-30%). Soils are deep, fertile and of volcanic origin; the litter layer exceeds 0.5 m in thickness at some locations within the stand. CE SJT receives abut 1300 mm of precipitation annually, with 90 percent falling between April and October; the mean temperature at the station is 8°C, with a mean maximum of 14°C in late spring and a mean minimum of 2.6°C in winter (Boyas 1985).

Plot location, layout, and site visits

In January 1995, the four scientists in the study conducted the first joint site visit at CE SJT. The general location of the study was identified, and eight square 4-ha treatment plots (200m x 200m) were installed. Within each 4-ha plot, one square 1-ha measurement plot (100m x 100m) was installed such that the border of the measurement plot was buffered on all sides by a 50m-wide strip of the larger treatment plot (Fig.1). Preliminary information on stand structure was collected from a set of ten variable-radius plots.

In the spring of 1995, Guries and Carrillo visited the Southern Station's ecosystem management research on the Ouachita National Forest in Hot Springs, AR. A four-day tour was coordinated by Guldin, with assistance from the Ouachita National Forest provided by J.C. Salazar, timber sale administrator on the Kiamichi RD. During this visit, scientists inspected many of the different research prescriptions imposed in the Arkansas work, with an emphasis on the shelterwood, single-tree selection, and group selection stands.

In the summer of 1995, Carrillo and Acosta conducted a 100% inventory of all trees 20.0 cm and larger in the eight 1.0-ha plots. Each tree was assigned a unique identification number embossed on a 5-cm diameter aluminum disk, which was nailed to the base of each tree. Guries assisted in this work during a one-week site visit. These data--essentially a 25 percent cruise--served as the basis for the quantitative description of stand conditions, and for the development of plot-specific marking prescriptions for the reproduction cutting method trials in the study area.

In December of 1995, Acosta visited Arkansas to inspect the Ecosystem Management research on the Ouachita National Forest. A five-day tour was coordinated by Guldin, with assistance from the Ouachita National Forest again provided by J.C. Salazar. Salazar, fluent in Spanish, was able to provide technical interpretations and translations. During this visit, special attention was given to the structure and appearance of the Arkansas shelterwood and single-tree selection research stands, since Acosta will be primarily responsible for overseeing the imposition of treatments at CE San Juan Tetla. In addition, Guldin and Acosta conducted preliminary analyses of the summer data, and developed the software to fit the detailed prescriptions to individual plots.

Finally, in January 1996, the four study scientists were joined by Ouachita NF technician Salazar for the critical trip to CE SJT in which the treatments were assigned and study plots marked. INIFAP provided two technicians for this work as well. This was exactly the necessary crew complement required to mark six 4-ha plots with the proper prescription. Trees are scheduled to be cut between February-April 1996.

Selection of treatments

Existing research points to the need for care when attempting to regenerate Montezuma pine. First, the species exhibits a pronounced periodicity in seed production, with good seed years only occurring (on average) every five years. Secondly, newly-established seedlings do not begin height growth immediately, but persist in a grass stage for several years. During this period, in light of the high elevations at which the species occurs, retaining sufficient residual overstory basal area to shelter the seedlings from high levels of solar insolation appears to be important. Thirdly, some research (Becerra, 1995) suggests that a delicate balance exists between grass-stage seedlings of *P. montezumae* and the most common herbaceous component, grasses of the *Muhlenbergia* genus; if the stand is opened too quickly, the response of the grass may be sufficient to outcompete the grass-stage seedlings.

Given these empirical observations, we believe that reproduction cutting methods for natural regeneration of Montezuma pine should emphasize retaining a large number of trees on the site after harvest. Thus, we identified the shelterwood and selection methods as the two most promising reproduction cutting methods to investigate in this study.

In the **shelterwood** method, marking guidelines can be uniquely determined by three parameters. The residual basal area controls the overall stocking of the residual stand. The percent of each diameter class retained allows the forester to cut the worst trees and leave the best across the full range of diameter classes, thereby improving residual tree quality. Finally, the maximum guiding diameter designates the biggest tree the forester will generally retain; virtually all the trees above this maximum diameter will be cut, unless their retention is required for quality, growth, optimum spacing, or other considerations. These three parameters describe a target residual stand. Marking guidelines are intended to specify how these parameters influence the marking of the actual stand.

In the **single-tree selection** method, marking guidelines are similarly determined by three unique parameters--the 'BDq' (Leak 1964, Marquis 1978). The BDq approach is used to develop a hypothetical negative-exponential target stand structure. The marking guidelines are prepared by comparing the actual existing stand to the hypothetical target, and making the necessary silvicultural adjustments to reconcile one with the other. In this approach, B refers to the residual basal area, which controls overall stocking of the residual stand. D refers to the maximum diameter retained; virtually all the trees above this maximum diameter will be cut. Finally, "q" (or "q-factor") refers to the ratio in the number of trees in a given nth diameter class to the number in the (n-1)th class. By this relationship, the q is essentially the negative-exponential factor which configures the given basal area to the "reverse J-shaped" (jota invertado) curve. The value of q depends on the width of the diameter class; a q for 2-inch diameter classes, for example, is the square of the corresponding q for 1-inch classes.

For this study, existing computer spreadsheets for the shelterwood and single-tree selection methods, which were originally developed in English units for use in Arkansas, were modified to metric units for use in Mexico. The range of stand structure response to these cutting methods was examined by comparing the all-plot diameter distribution in the pine component against four proposed shelterwood marking prescriptions and three proposed single-tree selection marking prescriptions. The parameters associated with these marking prescriptions are presented in Table 1.

Results from this preliminary examination of shelterwood (Figures 2a-2d) and single-tree selection (Figures 3a-3c) marking guidelines suggest that two of the four shelterwood treatments (the moderate and heavy shelterwoods, RBA 15 m^2/ha and RBA 20 m^2/ha) and one of the three single-tree selection treatments (the moderate BDq prescription, characterized by a target residual basal area of 21 m^2/ha, maximum diameter of retained trees of 90 cm, and a q for 5-cm classes of 1.21) represent an appropriate balance between operational feasibility and ecological practicality.

Assignment of treatments to plots

In a fully randomized and replicated silvicultural study, the assignment of treatments to plots would be a random process in which each plot has an equal probability of receiving any treatment. In this study, we decided not to do this, for several reasons. First, with a stand area capable of accomodating only eight plots, a full set of three replications is impractical and limits the silvicultural prescriptions that can be evaluated. Secondly, an arbitrary assignment of treatments in this study has practical advantages that outweigh the theoretical considerations. For example, subtle differences in structure exist across the eight measurement plots. It makes good silvicultural sense to assign reproduction cutting methods to plots that take advantage of this inherent structural variability, much as a forester would do when deciding which reproduction cutting method to use in a given stand. Finally, the practical division of plots to the north and south of the road allows convenience and a minimization of operational confusion as these reproduction cutting methods are applied. The importance of this last consideration is magnified when one considers that this study is the first to use the shelterwood method in CE San Juan Tetla since it was established over thirty years ago, and to our knowledge it also represents the inaugural test of BDq-type marking under single-tree selection in all of Mexico. Overall, then, treatments were assigned not only to plots best structured for their development, but also to plots best arranged along the roads for future demonstration value.

As a result, treatments were assigned to plots as follows. First, a practical decision was made to place the 4 shelterwood treatments (2 treatments x 2 replications) and one control stand in the five-plot block on the south side of the road (Fig. 1). Similarly, the 2 uneven-aged treatments (1 treatment x 2 replicates) and the second control were assigned to the three-plot block on the north side of the road.

Next, examining the diameter distributions led to the conclusion that plots 5 and 7, south and north of the road, respectively, most closely approximated the all-plot diameter distribution--that is, appeared to be the most typical of the overall average stand. Therefore, we designated these as control plots. By default, this placed the two replications of the uneven-aged treatment in plots 6 and 8.

To allocate the shelterwood treatments in plots 1 through 4, we decided to use the simple expedient of assigning the heavy shelterwoods to the plots with greater basal area, and the moderate shelterwoods to the plots with lesser basal area. Plots 1 and 4 had higher before-harvest pine basal areas than plots 2 and 3 (Table 2). Therefore, the 'heavy' shelterwood (RBA 20 m^2/ha) was then assigned to plots 1 and 4, and the 'moderate' shelterwood was assigned to plots 2 and 3.

Imposing the reproduction cutting treatments

Overview of the marking

Marking trees for research differs somewhat from marking trees for operational practice. Typical operational practice involves some method of designating the trees that will be cut. In the United States, the tree is marked with paint on the bole and at the stump. In Mexico, a blaze is hacked on the bole of the tree (through to the cambium) with a machete.

Conversely, silviculture researchers place extreme importance on the composition of the residual stands. Specific measurements to quantify the residual stand--for example, measuring and tallying every residual tree in the study plot--are more common in silvicultural research, especially small-plot studies such as this, than in operational practice.

Therefore, in this study, we decided to identify residual trees directly. This resulted in the most accurate after-marking assessments of residual stand condition. Trees were marked for retention by hacking a smooth area on the bark surface (not to the cambium) with a machete on the south face of the bole, and spraying this area with paint. This procedure was used both because of the rugged bark surface of *P. montezumae*, and because the marking paint available to us was not as intense or durable as standard U.S. tree marking paint.

This research approach has operational drawbacks at CE San Juan Tetla. First, the designation of trees to cut is typically the responsibility of the forester working for the logging contractor. INIFAP scientists must be sure that the contractor's personnel, especially the forester, are aware that for this study the trees to be cut are those which do not have an obvious orange or yellow spot on the south face of the bole. Secondly, trees were marked to leave only within the boundaries of the treatment plots. It is possible that a contractor who is unaware of the location of the plot boundaries could happily clearcut parts of the stand that lie beyond the flagged boundaries of the plots. This would be disastrous in the control plots (where residual trees were not marked) and is certainly undesirable from INIFAP's point of view.

Therefore, careful supervision of the contractor's forester and logging crew will be required to ensure that only unmarked trees within the boundaries of the six treatment plots are harvested. Special attention should be paid to maintaining the flagged treatment plot boundaries, or otherwise designating the plot boundaries. The contractor's forester should be reminded often that trees to retain are marked with paint on the south face of the bole, and also should be repeatedly oriented regarding plot boundaries. It might also be helpful to insert a clause in the logging contract that specifies extra indemnity (double or triple the log value) if a tree marked for retention is cut.

Preparation of target marking tallies

By marking the trees to be retained rather than the trees to be cut, research control of marking is straightforward. The preharvest 100 percent tally of the 1.0-ha measurement plot means that each 4-ha treatment plot has the equivalent of a 25% cruise. Thus, we used the 1-ha plot to develop target marking tallies for the trees being retained, by 5-cm diameter class for the 4-ha block. In so doing, we assumed that the stand condition of the 4-hectare treatment plot was accurately represented by the 1-ha measurement plot located in its center--a reasonable assumption in the study area.

For plots 1 and 4, the target marking tally was developed to leave 20 m^2/ha in the residual stand, according to the parameters for the 'heavy' shelterwood (Table 1a). For plots 2 and 3, the target marking tally was prepared to leave 15 m^2/ha in the residual stand, after the parameters for the 'moderate' shelterwood (Table 1a). For the single-tree selection treatment in plots 6 and 8, the target marking tally was prepared after the 'moderate' BDq (Table 1b), with a slight modification--D, the maximum diameter retained, was increased to 90 cm for consistency with the maximum diameter retained in the shelterwood treatments.

Marking the trees

In January 1996, the four scientists were joined by three technicians (two from INIFAP and one, J.C. Salazar, from the Ouachita NF) at CE San Juan Tetla. We formed three two-person field crews to mark the residual trees, with the seventh person responsible for maintaining the tally. Typically, one 4-ha treatment plot required three passes by this field crew, and took between three and four hours to mark. As a candidate tree was found, the d.b.h. was taken, and the datum literally shouted to the tally person. When the tally person indicated that the tree was acceptable to retain, the tree was marked as described above.

The marking process allowed the tally person to separate the tally for the 1-ha measurement plot from the tally for the remainder of the 4-ha treatment plot. This was desirable on several counts. Our top priority was to obtain the residual basal area in the 1-ha plot with an error of ± 10 percent. The second priority was to obtain the residual basal area, with an error of ± 10 percent, in the 4-ha plot. With limited field time, these priorities allowed the cooperators to make the best strategic decisions about which stands to revisit to refine the initial marking.

Overall, this field scheme gave the tally person good control of the marking process. Across all treatments, we felt that the important stand variable to attain was residual basal area. Exactly matching the target marking tally in every size class would assure this. However, marking generally deviated slightly from the target due to legitimate silvicultural considerations such as residual tree size, tree spacing, or sampling error (the underlying assumption that the 1-ha measurement plot exactly reflects the 4-ha treatment plot was the exception rather than the rule). The tally person was generally able to compensate for classes in which the marking is deficient by allowing other classes to exceed the target. Technically, compensation is made by equivalent basal area; with educated guessing, the tally person was able to guide the marking by trading trees in undermarked classes for trees in overmarked classes, and thus to achieve the target residual basal area.

Site Preparation and Release Treatments

After the harvest has been conducted, certain silvicultural activities will be required to ensure establishment and development of the regeneration obtained as a result of the reproduction cutting. It is difficult to specify what these treatments will be, and when they will be imposed. These decisions must be made based on whether the reproduction cutting occurs in the presence or absence of a productive seed year for *P. montezumae*. We anticipate that the reproduction cut will not be associated with a good seed year, since there are more poor seed years than good ones. As a result, site preparation and release will be prescribed based on after-harvest conditions as silvical conditions warrant.

We anicipate that site preparation and release treatments will be restricted to manual practices. Neither herbicide treatments nor prescribed fire are commonly used in Mexican forestry. For site preparation treatments, all unwanted woody stems >5 cm diameter will be felled using a chainsaw during the dormant season. Unwanted stems are those in excess of RBA goals for the reproduction cutting methods described above; in some cases this will mean complete elimination of all hardwoods.

Release treatments will be prescribed as needed beginning the second year after site preparation. Again, only manual felling would be used to achieve release pine regeneration and to minimize competition. Emphasis will be given to identifying intensities of release treatments sufficient to promote early growth. At least three treatment intensities (minimum: only overtopping hardwood sprouts saplings removed; medium: sprouts, saplings, and poles within a specified distance to pine regeneration removed; intense: essentially all sprouts, saplings, and poles removed, together with some overstory trees) will be considered.

RESULTS TO DATE

Pretreatment condition, CE San Juan Tetla

Prior to treatment, this stand contained 156.1 trees/ha and 37.61 m^2/ha, of which 110.9 trees/ha and 32.75 m^2/ha was Montezuma pine (Tables 3a and 3b). Montezuma pine consisted of 70 percent of the stems per hectare, and 87 percent of the basal area per hectare, based on the 8-ha 100-percent inventory. Among the eight 1-ha measurement plots, total basal area varied from 33.6 to 40.7 m^2/ha, basal area of Montezuma pine ranged from 30.3 to 37.6 m^2/ha, and the percentage of Montezuma pine basal area varied from 76 to 93 percent. Stand tables that summarize trees per hectare and basal area per hectare (m^2/ha) by species and 5-cm diameter class for each of the eight plots in the study are presented in Appendix Tables 1-8.

One of the most interesting aspects of these stands is the size of the trees. In the study area, the quadratic mean diameter of Montezuma pine was 61.3 cm (24 in), and 3.5 percent of the Montezuma pine trees in the study had diameters that exceed 90 cm (36 in). Several quick measurements of height and age in January 1995 indicated that dominant Montezuma pines were approximately 35 m in height and 90 years old. The large size of trees in the study area was not unique to Montezuma pine; several specimens of *P.ayacahuite* with similar diameters were observed in the study area. The largest tree in the 8-ha data base was a fir with a diameter exceeding 1.4 m. All in all, these are magnificent forest stands.

In general, pines dominated the larger size classes, and hardwoods were most prominent in the smaller size classes (Fig. 4). The distribution of the pine component was a bimodal normal distribution, which parallels the condition generally found in other pine stands such as Interior Highlands shortleaf pine stands in Arkansas (Guldin and others 1994). The hardwoods exhibited a negative exponential distribution in the smaller size classes, another common element with shortleaf pine stand structure in Arkansas. However, in these Montezuma pine stands, pines outnumbered hardwoods in all but the smallest size classes (Fig.4).

Marking accuracy--target vs. final marking tallies

Accuracy of marking refers to the degree to which the final marking tally conforms with the target marking tally. We did not deem it critical for the final tally to exactly match the target, since many reasonable silvicultural factors such as tree quality, spatial distribution, and sampling accuracy came into play.

Accuracy judged by basal area

A summary comparison of the target marking tally versus final marking tallies (Table 4) shows that the final marking tally for the measurement plots was fairly close to the residual basal area target. Absolute value differences between the target and final residual basal area for the measurement plot ranged from 0.34 to 1.79 m^2/ha (plots 4 and 3, respectively), with relative percentages of from 1.0 to 11.9 percent (plots 6 and 3, respectively). With the exception of plot 3, the difference in target versus final marking tallies for the measurement plots was less then 4 percent.

The buffers around the measurement plots were not as accurately marked. Absolute differences between target and final residual basal area for the buffer plots ranged from 0.89 to 6.08 m^2/ha (plots 2 and 4, respectively), with relative percentages of from 5.6 to 30.3 percent (plots 6 and 4, respectively). Only the two heavy shelterwood buffers exceeded a ten percent margin of error.

The total treatment plot is simply a weighted average of the buffer and the measurement plot. Absolute differences between target and final residual basal area for the treatment plots ranged from 0.80 to 4.82 m^2/ha (plots 2 and 4, respectively) with relative percentages of from 4.0 to 24.1 percent (plots 6 and 4, respectively). Again, only the heavy shelterwoods exceeded the ten percent margin of error, due to the buffer basal areas being marked more like a moderate shelterwood treatment than a heavy shelterwood treatment.

Accuracy judged by diameter distributions

Heavy shelterwood

Plot 1. The final tally of the 1-ha measurement plot and the target marking tally showed fairly close agreement (Fig. 5a). In the diameter classes where the target marking tally was nonzero, the final tally of the inventory plot was less than the target in five of the eight classes. Trees were also retained on the plot in one diameter class below the target and in two diameter classes above the target. Conversely, the 3-ha buffer was consistently below the target, especially in the 57.5-cm to 77.5-cm diameter classes (Fig. 5a). However, the diameter distribution of the trees retained in the buffer was typical of a classic normal or 'bell-shaped' curve.

The 4-ha treatment plot showed the classic pattern of the shelterwood reproduction cutting method, as judged by comparing the preharvest stand with the residual stand as marked (Fig. 5b). No trees in the small diameter classes were to be retained, and only a small percentage of the best trees in the imtermediate size classes were to be retained. The largest size classes below the Dmax were largely retained, for seed production and continued volume and value increment. A few trees above the Dmax were retained, primarily because of high quality or, more likely, because their removal would have left an excessively large opening in the stand.

Plot 4. The 1-ha measurement plot conformed closely to the target marking tally (Fig. 6a). Of the seven nonzero diameter classes in the target marking tally, the final tally was less than the target in five. However, most of these classes were fairly close to the target. Trees greater than the Dmax were retained to account for the deficits. Conversely, as in Plot 1, the 3-ha buffer plot was below than the target marking tally in most diameter classes, especially in the 62.5-cm and 67.5-cm classes (Fig. 6a). These diameter classes were occupied by a large percentage of poorly-formed small-crowned trees whose retention was not justified simply to meet the marking tally. A small number of trees above the Dmax were retained to partially account for the shortfall in buffer plot basal area, though not as many as in Plot 1.

The final tally for the 4-ha treatment plot illustrates the classic shelterwood marking (Fig. 6b), similar to that seen in Plot 1 as well. None of the small-diameter trees were retained. Only a small percentage of the intermediate size classes were retained, and as in the case with Plot 1, these were the best of the smaller trees. Between one-half to two-thirds of the larger size classes below the Dmax were retained, since these were usually overstory codominants or dominants of good form and good seed-production potential. Finally, a small proportion of trees above the Dmax were retained, again due to stem quality or spacing.

Moderate shelterwood

Plot 2. The 1-ha plot final tally agrees very closely with the target marking tally (Fig. 7a). Of the six non-zero diameter classes in the target tally, the final plot tally was less than the target in five; however, the deviation was small. No trees were retained above the Dmax in the measurement plot; however, several trees were retained in diameter classes below the target. The reason for this was that although the target specified that no trees be retained in diameter classes less than 67.5 cm, there were some high-quality trees in these classes whose retention made sense silviculturally.

The diameter distribution of the 3-ha buffer plot had a lower peak and wider tails than the target distribution (Fig. 7a). Since the buffer plot constituted three-quarters of the 4-ha treatment plot, the diameter distribution of the treatment plot was similarly broader and flatter than the target (Fig. 7b). We interpret this as an artifact of tree quality, in which the best trees were retained in a range of diameter classes based on field decisions about spacing and quality that cannot be anticipated in a target tally. Overall, the diameter distribution for the 4-ha treatment plot exhibited a nice bell-shaped curve which, in relation to the preharvest distribution, is typical of the shelterwood method.

Plot 3. The 1-ha plot showed only moderate agreement with the marking tally (Fig. 8a). In the six nonzero diameter classes in the target distribution, the plot tally was less than the target in three, and greater in the other three--but the differences were pronounced, such as in the 82.5-cm class. Trees were also retained in three diameter classes below, and two diameter classes above, the target distribution. The 3-ha buffer plot was equally ragged versus the target (Fig. 8a). In both instances, these deviations were based on good silvicultural decision-making. The best trees were retained across the range of diameter classes, in part due to variations in stem spacing and tree quality across the plot.

Given that the 1-ha plot and the 3-ha buffer raggedly conformed to the target, it should not be surprising that the 4-ha treatment plot was also ragged in relation to the target (Fig.

8b). The peak of the diameter distribution of the residual trees on the treatment plot was less than the target, and formed a flat peak from the 62.5-cm to the 77.5-cm diameter classes. Trees were retained in three diameter classes below the target, and at low levels in five diameter classes above the target--reflecting the silvicultural decisions alluded to above.

Moderate BDq--single-tree selection

Plot 6. The philosophy that underlies uneven-aged silviculture can be seen in the graphical development of the target from the preharvest measurement, guided by the BDq relationship (Fig. 9a). The BDq curve defined the negative exponential, or 'reverse J-shaped' (jota invertado) curve, across all diameter classes less than the Dmax. When this was compared to the existing preharvest stand, diameter classes invariably existed in which the preharvest stand was deficient in trees per unit area relative to the BDq -- in this case, all diameter classes 47.5 cm and smaller, and the 87.5-cm class. As a result, additional trees were retained in the diameter classes where the number of trees was surplus relative to the BDq--in this case, the 52.5-cm to the 82.5-cm classes. The target marking tally reflected this adjustment, such that the overall stand basal area of the proposed residual stand equalled B in the hypothetical BDq.

After marking, most of the diameter classes in the final measurement plot contain fewer trees than the target (Fig. 9b). When the target was developed, we assumed that all trees in deficit classes would be retained. But this assumption is rarely robust, since some of the trees in these diameter classes were of poor form and quality. Keeping these poor trees simply because they are in deficit classes to begin with did not make silvicultural sense.

The question about what to do with small trees in deficit size classes is often raised by foresters inexperienced with the method--since it is a common situation to discover a tree of marginal merchantability and poor form in a deficit class next to a larger merchantable tree in a surplus class which, according to the BDq, should be marked. The question is even more important when, as is often the case, the small trees are unmerchantable and can only be removed at a cost.

At San Juan Tetla, we decided to cut the poor trees and leave the best, regardless of size. This led to the large relative differences between target and final tally in the smaller classes, and also resulted in roughly 50% more trees than the target in the 67.5-cm and 72.5-cm classes--compensation necessary to achieve the target residual basal area.

The distribution of residual trees in the 3-ha buffer more closely conformed with the target marking tally. In this plot, the small trees seemed to be more numerous in the buffer than the measurement plot. This resulted in a larger number of trees retained in the small diameter classes in the buffer. Across the 4-ha treatment plot, the residual stand conformed closely with the target marking tally as well (Fig. 9c).

Plot 8. Of all the plots in the study, this plot was most suited to the BDq method because of the high number of trees in the smaller diameter classes. As a result, the target marking tally was closer to the BDq curve because there was less basal area to redistribute in the surplus classes (Fig. 10a).

When marking this plot, the same condition discussed in plot 6 was encountered--the smaller size classes contained a large proportion of unacceptable trees. As a result, both the final 1-ha plot tally and the 3-ha buffer plot tally required incurring greater deficits in the small classes, and greater compensation in the surplus classes, than was called for in the target (Fig. 10b). The 4-ha plot showed the same final pattern (Fig. 10c).

FUTURE RESEARCH

Post-treatment measurements

Re-establishment of research plots and remeasurement of the 1-ha measurement plots will be made initially in the summer of 1996 following reproduction cutting. These data are necessary to confirm the actual condition of the post-treatment stand conditions, and to compare the actual results of harvest with the final marking tallies described above.

In addition, a series of nested plots will be established with the smallest interior plots (1 m2) for assessment of woody seedlings less than 1.5 m height and 1 cm diameter. Herbaceous cover can also be assessed here for biodiversity and/or phytosociological studies, if resources and interest permit. A second larger nested plot (4 m x4 m) will be used to assess saplings between 1-10 cm diameter. This set of nested plots will permit us to quantify the response of the woody plant component to the cutting and release treatments.

It would be most desirable to reinventory the plots and subplots for three consecutive years to assess the establishment and development of regeneration, as well as the growth of sapling, midstory and overstory trees. Overstory trees will be tallied by species and diameter using tree identifications assigned earlier; any mortality from the previous measurement period will be noted. Midstory trees will also be remeasured similarly, and ingrowth trees will be assigned new identification numbers. Regeneration will be assessed on the nested subplots and followed over time. But as of this report, support for the extended program of measurements is not available through either the USDA Forest Service or INIFAP. However, we anticipate that the current structure and condition of the study will optimize the likelihood of future funding when funding sources are identified.

Dissertation research projects

Despite concerns about future funding sources, we have funding in hand to complete two projects based on the current project to date (assuming reproduction cutting is completed). These projects will be integral elements of Carrillo's dissertation at the University of Wisconsin-Madison.

Project #1: Seeds stored in the forest floor in a natural stand of *P. montezumae*

Description

Knowledge of the amounts of buried seed of different species is important in studies of secondary plant succession and management of logged stands. Some plant species emerging in disturbed forest areas are not found in the mature forest, suggesting an origin from migrant or buried seed (Strickler and Edgerton, 1976). Unfortunately long-term storage of seeds in the forest floor is more characteristic of undesirable pioneer trees, annuals, and shrubs than of commercial tree species. Many of these weeds have seeds with hard, nearly impermeable coats that allow the embryos to survive for the many decades that may elapse between major fires or similar regenerative disturbances. Examples of such species are the genera Rubus, Ribes, and Ceanothus, as well as the short-lived pin cherry (Smith, 1986).

Adequate amounts of seed of a few species may remain viable in the humus layers beneath uncut stands for periods longer than one year. With such species it is often possible to expect seemingly miraculous regeneration after harvesting the entire source of seed (Smith, 1986). Upon site disturbance, seed buried in the soil may be exposed to conditions suitable for germination. Composition, depth distribution, and density of seed buried in the litter and soil all interact with the environmental factors associated with various types of disturbance to determine species composition of the stand following disturbance. Pre disturbance and post disturbance stand composition may differ dramatically. Such differences emphasize the importance of buried viable seed in the successional dynamics on the disturbed site. To understand the contribution of seed propagules to successional dynamics, it is essential to understand the composition and spatial distribution of seed banks and their responses to environmental conditions (Pratt and others 1984). The purpose of this study will be to characterize the seed bank of the *P. montezumae* stand at the CE San Juan Tetla.

Methods

Soil and litter samples will be collected during June of 1996. Cores of litter and mineral soil (15 X 15 X 60 cm deep) will be collected from plots in March, after seed dispersion of the 1995 seed crop. Four randomly distributed samples will be taken in every of the eight blocks. All cores will be separated into litter and mineral soil. The litter layer at San Juan Tetla can be deep, as much as 60 cm at some sites, so this layer will be separated into 10 cm intervals. Two mineral soil depths, 0-2.5 and 2.5-5 cm will be also assessed. The samples for each depth interval from all the plots will be placed in a plastic bag and thoroughly mixed. All the samples will be placed in the greenhouse at San Juan Tetla Forest Station or the University of Chapingo. Numbers and emergence time of seedlings will be recorded for 6 months. Some plants will be removed after identification to eliminate crowding of new emergents or to prevent seed production when mature. Plant identification will be based on the complete list made by Boyas (1985) specifically for the CE San Juan Tetla. Projected seedling numbers per square meter of forest floor will be computed from core area and total core weights of litter and soil.

Project #2. Canopy disturbance frequency and intensity in a temperate *P. montezumae* forest in Puebla, Mexico

Description

Studies of the effects of forest succession require an assessment of forest age structure and disturbance history or the degree to which a stand has approached steady-state conditions. Evaluation of forest stand history is also the principal basis for estimating regional natural disturbance frequency in areas with little human disturbance. Regional studies of natural disturbance regimes have been useful in understanding forest stand dynamics at the landscape level, and have served as guides for restoring natural vegetation complexes in wilderness areas (Lorimer and Frelich 1989).

Three general field techniques are available for reconstructing stand disturbance history. Each technique is best suited for analyzing a specific type of disturbance. Dates of catastrophic disturbance are often determined from data on stand age structure. Frequency of surface fires is usually estimated by analyzing fire scar dates on surviving trees. Frequency of small gap disturbance can be assessed by direct study of gaps formed in the previous 10- to 30-year period (Lorimer and Frelich 1989).

Dendrochronology involving the use of tree-ring chronologies represents an important approach for evaluating past and present forest conditions (Fritts and Swetnam 1989). Variations in tree-ring width can be used to reconstruct the occurrence of past disturbances in forests, as well as climatic impacts on tree growth. For example, growth increases of 100% or more which last at least 15 years are often interpreted as a response to a major disturbance in closed forest (Lorimer and Frelich 1989). It is generally assumed that climatic effects on tree growth are typically of shorter duration or intensity in temperate forests. Moreover, disturbance events that create canopy gaps generally simulate a "pulse" of tree establishment or canopy recruitment, which is not expected simply from short-term climate changes. Therefore, the coupling of tree-ring chronologies with tree establishment or recruitment dates represents an important, but under-utilized, technique for studying disturbance history and successional dynamics of forest (Abrams and others 1995).

In the Central Region of Mexico, Montezuma pine has long dominated the landscape and the forest economy. Today, however, its natural regeneration is threatened by adverse pressures induced by ecological and human sources, such as fire exclusion and overgrazing. Young seedlings die from frost, extended periods of drought, exposure to direct sunlight, pests, disease, frequent fires, predation, grazing, and browsing (Musalem 1984). When the density of mature stands is lowered, invasion by grasses, *Salix* spp, *Alnus* spp, *P. ayacahuite*, and *A.religiosa* is common (May 1971).

The purpose of this study will be to examine the dendrochronological record of suppression and releases of *P. montezumae* and *P. ayacahuite*, and successional changes over a period of approximately 100 years, to gain insight into the patterns of tree recruitment in relation to disturbance events in forest of *P. montezumae* in CE San Juan Tetla.

Methods

Fixed-area plots will be located in the plots with a *P. montezumae-P. ayacahuite* canopy. The species, diameter and crown class will be recorded for all trees (DBH >8 cm at height of 1.20 m) occurring within 0.10-ha circular plots at each point. At each plot, three or four representative trees across all species and age classes will be cored at 1.20 with Haglof increment borers for age determinations and radial growth analysis. All suitable cores will be returned to the laboratory for examination. Additionally, a limited number of pole size or small sawlog *P. ayacahuite* will be harvested for stem analysis to examine the rate and timing of gap closure by this competitor of *P. montezumae*.

Age determination for all cores will be made using a dissecting microscope. Cores from the four oldest *P. montezumae* will be used to construct a growth chronology of the site spanning 100 years. These cores will be dried, mounted and sanded. Annual growth increments will be measured to the nearest 0.01 mm with a tree-ring measuring device and recorded using the MACDENDRO microcomputer program. After cross-dating using "signature years" annual increments will be averaged to obtain a mean growth chronology from the cores. A ring width index will be also created for each tree chronology by dividing yearly mean measured growth values by the expected values from linear regression.

All cores will be examined for periods of suppression and release based on conservative and moderate criteria established by Lorimer and Frelich (1989), who defined a major sustained release as 100% average growth increase lasting at least 15 years, and a moderate temporary release as 50% average growth release lasting from 10 to 15 years.

Data Analysis

Data analysis procedures will be tailored to the individual studies and projects under consideration. Statistical packages such as the Statistical Analysis System (SAS), are readily available to Mr. Carrillo on the Madison campus. In addition, statistical consulting is available on campus to researchers working on complex or innovative problems. Several well-equipped and staffed computer labs are also available at Madison.

EXPECTED OUTCOMES

Three important outcomes are anticipated in this study. First, the study is an opportunity to examine a set of innovative reproduction cutting methods under experimental conditions to determine whether natural regeneration of *P. montezumae* is silviculturally feasible and, if so, under what conditions of overstory retention and understory intervention. This expands the range of silvicultural knowledge of reproduction cutting methods in application to the species, and will be valuable for all scientists in the study.

Second, the study provides an opportunity for a comparative assessment of stand-level ecosystem management alternatives in two different pine-dominated ecosystems in Arkansas and Puebla. Partial cutting methods such as these, featuring maintenance of a residual stand and development of mixtures of pines and hardwoods, have unknown outcomes for timber management, biodiversity, wildlife habitat, and related values. This study provides the opportunity to test the extent and applicability of 'generalizations' about the reproduction cutting methods and stand dynamics in different pine-dominated ecosystems.

Third, the act of bringing this study to fruition provides tremendous opportunities for U.S.-Mexico collaboration in pine silviculture and other areas. Collaboration is easiest to build when both parties recognize the value of devising management schemes of mutual benefit, with application across a range of ecosystems, and for which close collaboration is required in data collection and analysis. Forest Service, INIFAP, and University scientists will all benefit in learning the results of installing comparable reproduction cutting methods in different ecosystems, and then following subsequent stand development as well as the impact on other resources.

ACKNOWLEDGEMENTS

The authors thank the administrative directorate of Region Centro, INIFAP, Chapingo MEX for outstanding support and access to the research site, as well as for the in-kind services of housing and technical support. Thanks also go to Dr. Sheila Andrus, Ms. Vicky Estrada, and Dr. Elvia Niebla of the Washington Office of the USDA Forest Service, without whose support this research would not be underway. The authors extend a special thanks to Mr. Juan C. 'Charley' Salazar, Timber Sale Administrator, Kiamichi RD, Ouachita NF, for his invaluable assistance in the operational aspects of this study in both the United States and in Mexico.

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TABLE 1. Elements of the shelterwood and single-tree selection prescriptions tested in the study. Designations of 'light', 'moderate', 'heavy', and 'maximum' are subjective descriptions of the stocking in the residual stand after the prescription is imposed.

A. Shelterwood marking guidelines

Treatment	Residual Basal area	Percent of diameter retained	Maximum diameter retained
	- m^2/ha -	- percent -	- cm -
'Light' shelterwood	10	75	90
'Moderate' shelterwood	15	75	90
'Heavy' shelterwood	20	80	90
'Maximum' shelterwood	25	80	100

B. Single-tree selection marking guidelines

Treatment	B, Residual basal area	D, maximum diameter class retained	q, ratio between 5-cm diameter classes
	- m^2/ha -	- cm -	
'Light' BDq	18	77.5	1.44
'Moderate' BDq	21	87.5	1.21
'Heavy' BDq	24	97.5	1.10

TABLE 2. Final assignment of treatments to plots, based on the subjective procedure described in the text.

Plot	Treatment	Pine Basal area before harvest	Projected Pine RBA after treatment
		- m^2/ha -	- m^2 /ha -
A. Plots south of road			
1	Heavy shelterwood	35.55	20
2	Moderate shelterwood	32.13	15
3	Moderate shelterwood	33.34	15
4	Heavy shelterwood	38.17	20
5	Control	30.32	as before
B. Plots north of road			
6	Moderate BDq	31.69	21
7	Control	38.22	as before
8	Moderate BDq	36.11	21

TABLE 3. Stand table before harvest by species and 5-cm diameter classes for all plots, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of eight 1.0-hectare plots. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

A. Trees per hectare, all plots

DCL5CM	Pinus montezumae	Pinus ayacahuite	Pinus teocote	Abies religiosa	Alnus firmifolia	Salix oxylepis	Other Salix sp.	Quercus sp.	All sp.
22.5	5.0	3.1	0.0	0.4	6.8	5.4	0.6	0.3	21.5
27.5	4.5	1.1	0.0	0.3	4.3	0.4	0.6	0.1	11.3
32.5	3.5	1.4	0.0	0.9	5.6	0.3	0.1	0.0	11.8
37.5	4.0	0.8	0.1	0.4	3.5	0.3	0.0	0.1	9.1
42.5	7.6	0.3	0.0	0.0	1.8	0.0	0.0	0.0	9.6
47.5	7.1	0.5	0.1	0.0	1.0	0.0	0.0	0.0	8.8
52.5	10.1	0.3	0.0	0.0	1.0	0.0	0.0	0.1	11.5
57.5	12.8	0.3	0.0	0.0	0.9	0.0	0.0	0.0	13.9
62.5	13.9	0.4	0.1	0.0	0.1	0.0	0.0	0.0	14.5
67.5	12.4	0.1	0.0	0.0	0.1	0.0	0.0	0.0	12.6
72.5	11.9	0.5	0.0	0.0	0.0	0.0	0.0	0.0	12.4
77.5	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1
82.5	5.3	0.3	0.0	0.1	0.0	0.0	0.0	0.0	5.6
87.5	1.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	2.1
92.5	2.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	2.1
97.5	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
102.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
107.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
112.5	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3
117.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
122.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
127.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
132.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
137.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
142.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
147.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
TOTAL	110.9	9.5	0.4	2.1	25.0	6.3	1.4	0.6	156.1

TABLE 3, cont'd. Stand table before harvest by species and 5-cm diameter classes for all plots, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of eight 1.0-hectare plots. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

B. Basal area, m² per hectare, all plots

DCL5CM	Pinus montezumae	Pinus ayacahuite	Pinus teocote	Abies religiosa	Alnus firmifolia	Salix oxylepis	Other Salix sp.	Quercus sp.	All sp.
22.5	0.20	0.12	0.00	0.01	0.27	0.21	0.02	0.01	0.85
27.5	0.27	0.07	0.00	0.01	0.25	0.02	0.04	0.01	0.67
32.5	0.29	0.11	0.00	0.07	0.47	0.02	0.01	0.00	0.97
37.5	0.44	0.08	0.01	0.04	0.39	0.03	0.00	0.01	1.01
42.5	1.08	0.04	0.00	0.00	0.25	0.00	0.00	0.00	1.37
47.5	1.26	0.09	0.02	0.00	0.18	0.00	0.00	0.00	1.55
52.5	2.19	0.05	0.00	0.00	0.22	0.00	0.00	0.03	2.49
57.5	3.31	0.06	0.00	0.00	0.23	0.00	0.00	0.00	3.60
62.5	4.26	0.12	0.04	0.00	0.04	0.00	0.00	0.00	4.45
67.5	4.43	0.04	0.00	0.00	0.04	0.00	0.00	0.00	4.52
72.5	4.90	0.21	0.00	0.00	0.00	0.00	0.00	0.00	5.11
77.5	3.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.36
82.5	2.81	0.13	0.00	0.07	0.00	0.00	0.00	0.00	3.01
87.5	1.13	0.15	0.00	0.00	0.00	0.00	0.00	0.00	1.28
92.5	1.34	0.08	0.00	0.00	0.00	0.00	0.00	0.00	1.43
97.5	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.93
102.5	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41
107.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112.5	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.25
117.5	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
122.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
127.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
132.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
137.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
142.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
147.5	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.21
TOTAL	32.75	1.61	0.07	0.42	2.33	0.28	0.07	0.06	37.61

TABLE 4. Comparison of marking accuracy for residual density (trees per hectare) and residual basal area (m^2/ha) by treatment and plot, among four variables: target marking tally, final tally for the 1-ha measurement plot, final tally for the 3-ha buffer, and final tally for the 4-ha treatment plot.

Treatment and plot	Target	Measurement Plot (1 ha)	Buffer Plot (3 ha)	Treatment Plot (4 ha)
I. Residual density, trees/ha				
A. Heavy shelterwood				
Plot 1	54.75	48.00	37.33	40.00
Plot 4	55.25	53.00	35.00	39.50
B. Moderate shelterwood				
Plot 2	35.75	36.00	34.67	35.00
Plot 3	35.00	41.00	39.33	39.75
C. Moderate BDq				
Plot 6	82.00	71.00	77.00	75.50
Plot 8	115.25	94.00	92.67	93.00
II. Residual basal area, m^2/ha				
A. Heavy shelterwood				
Plot 1	20.02	19.25	15.56	16.48
Plot 4	20.04	20.38	13.96	15.56
B. Moderate shelterwood				
Plot 2	15.01	14.46	14.12	14.21
Plot 3	15.02	16.81	16.13	16.30
C. Moderate BDq				
Plot 6	20.98	21.19	19.80	20.15
Plot 8	20.98	21.74	19.52	20.08

LIST OF FIGURES.

FIGURE 1. Map of the layout of 4-hectare treatment plots and 1-hectare measurement plots in the study area at CEF San Juan Tetla. SJT HQ refers to the compound where the main buildings are located.

FIGURE 2. Graphical distribution of before-cut and projected after-cut stand structure, based on application of the shelterwood method at CEF San Juan Tetla study area. Data are based on 100 percent inventory of eight 1.0-ha measurement plots. RBA=residual basal area; Dmax=maximum diameter retained.

A. Light shelterwood
(RBA=10 m^2/ha, 75% retained by class, Dmax=90 cm)
B. Moderate shelterwood
(RBA=15 m^2/ha, 75% retained by class, Dmax=90 cm)
C. Heavy shelterwood
(RBA=20 m^2/ha, 80% retained by class, Dmax=90 cm)
D. Maximum shelterwood
(RBA=25 m^2/ha, 80% retained by class, Dmax=100 cm)

FIGURE 3. Graphical distribution of before-cut and projected after-cut stand structure, based on application of the single-tree selection method at CEF San Juan Tetla study area. Data are based on 100 percent inventory of eight 1.0-ha measurement plots. B=residual basal area; D=maximum diameter retained; q=q ratio for 5-cm diameter classes.

A. Light BDq (B=18 m^2/ha, D=77.5 cm, q=1.44)
B. Moderate BDq (B=21 m^2/ha, D=87.5 cm; q=1.21)
C. Heavy BDq (B=24 m^2/ha, D=97.5 cm, q=1.10)

FIGURE 4. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies and hardwoods (hojosas) at CEF San Juan Tetla study area. Data based on 100 percent inventory of eight 1.0-ha measurement plots.

FIGURE 5. Heavy shelterwood treatment, Plot 1.

a. Target residual tree marking tally versus final tally for both the 1-ha measurement plot and the 3-ha buffer plot.

b. Preharvest diameter distribution, target residual tree marking tally, and final tally for the 4-ha treatment plot.

LIST OF FIGURES, cont'd.

FIGURE 6. Heavy shelterwood treatment, Plot 4.

a. Target residual tree marking tally versus final tally for both the 1-ha measurement plot and the 3-ha buffer plot.

b. Preharvest diameter distribution, target residual tree marking tally, and final tally for the 4-ha treatment plot.

FIGURE 7. Moderate shelterwood treatment, Plot 2.

a. Target residual tree marking tally versus final tally for both the 1-ha measurement plot and the 3-ha buffer plot.

b. Preharvest diameter distribution, target residual tree marking tally, and final tally for the 4-ha treatment plot.

FIGURE 8. Moderate shelterwood treatment, Plot 3.

a. Target residual tree marking tally versus final tally for both the 1-ha measurement plot and the 3-ha buffer plot.

b. Preharvest diameter distribution, target residual tree marking tally, and final tally for the 4-ha treatment plot.

FIGURE 9. Marking accuracy, moderate BDq single-tree selection treatment, Plot 6.

a. BDq structure, preharvest diameter distribution, and target marking tally.

b. Target residual tree marking tally versus final tally for both the 1-ha measurement plot and the 3-ha buffer plot.

c. Preharvest diameter distribution, target residual tree marking tally, and final tally for the 4-ha treatment plot.

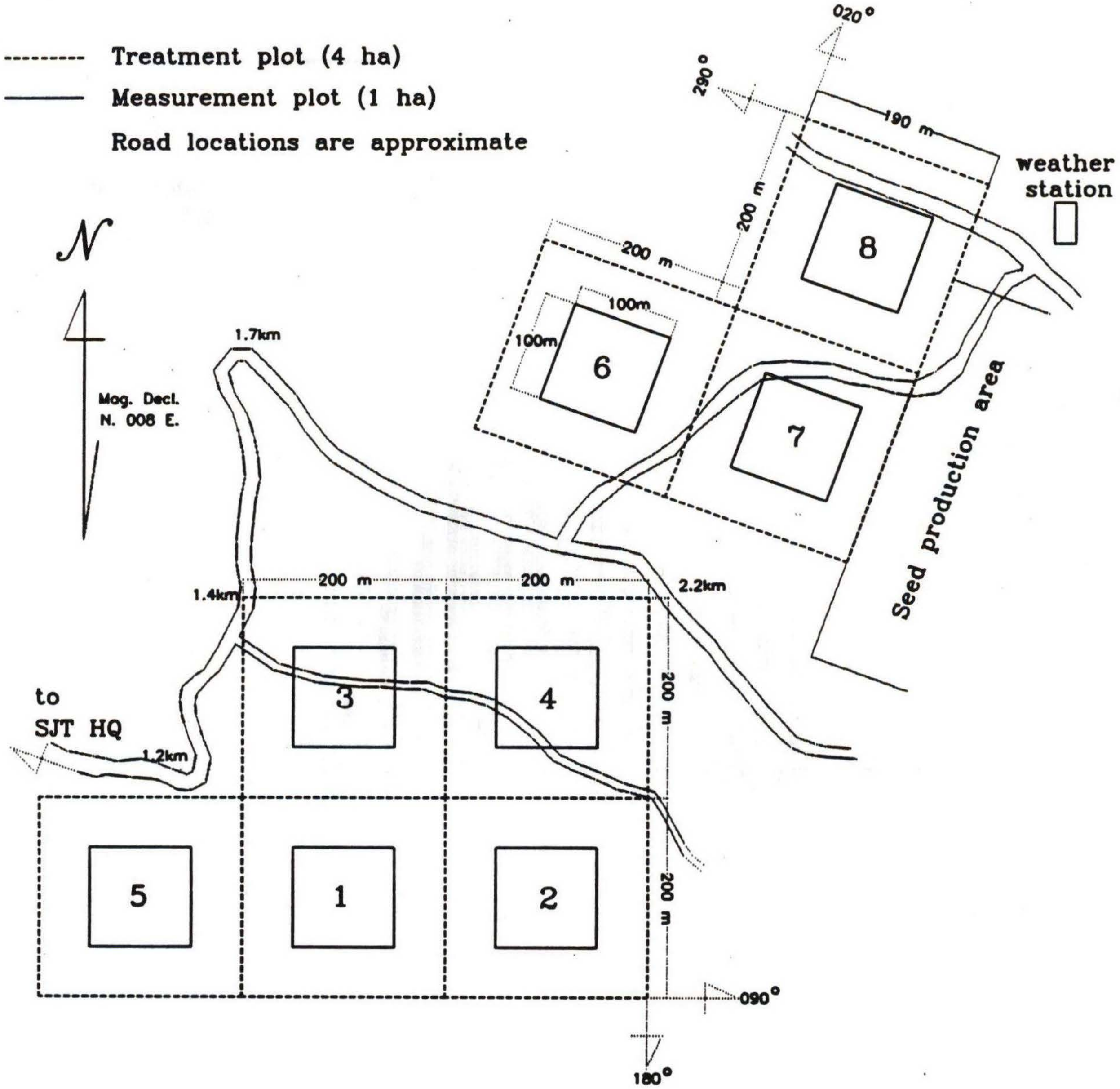
FIGURE 10. Marking accuracy, moderate BDq single-tree selection treatment, Plot 8.

a. BDq structure, preharvest diameter distribution, and target marking tally.

b. Target residual tree marking tally versus final tally for both the 1-ha measurement plot and the 3-ha buffer plot.

c. Preharvest diameter distribution, target residual tree marking tally, and final tally for the 4-ha treatment plot.

FIGURE 1. Map of the layout of 4-hectare treatment plots and 1-hectare measurement plots in the study area at CEF San Juan Tetla. SJT HQ refers to the compound where the main buildings are located.



--------- Treatment plot (4 ha)
——— Measurement plot (1 ha)
Road locations are approximate
N
Mag. Decl.
N. 008 E.
020°
290°
190 m
200 m
200 m
100m
100m
weather station
Seed production area
1.7km
1.4km
1.2km
2.2km
to SJT HQ
200 m
200 m
200 m
200 m
090°
180°
1
2
3
4
5
6
7
8

SJT2.DWG, rev. 01986, JMG

FIGURE 2. Graphical distribution of before-cut and projected after-cut stand structure, based on application of the shelterwood method at CEF San Juan Tetla study area. Data are based on 100 percent inventory of eight 1.0-ha measurement plots. RBA=residual basal area; Dmax=maximum diameter retained. Filename: SWSJTMET.WB1.

A. Light shelterwood (RBA=10 m^2/ha, 75% retained by class, Dmax=90 cm)

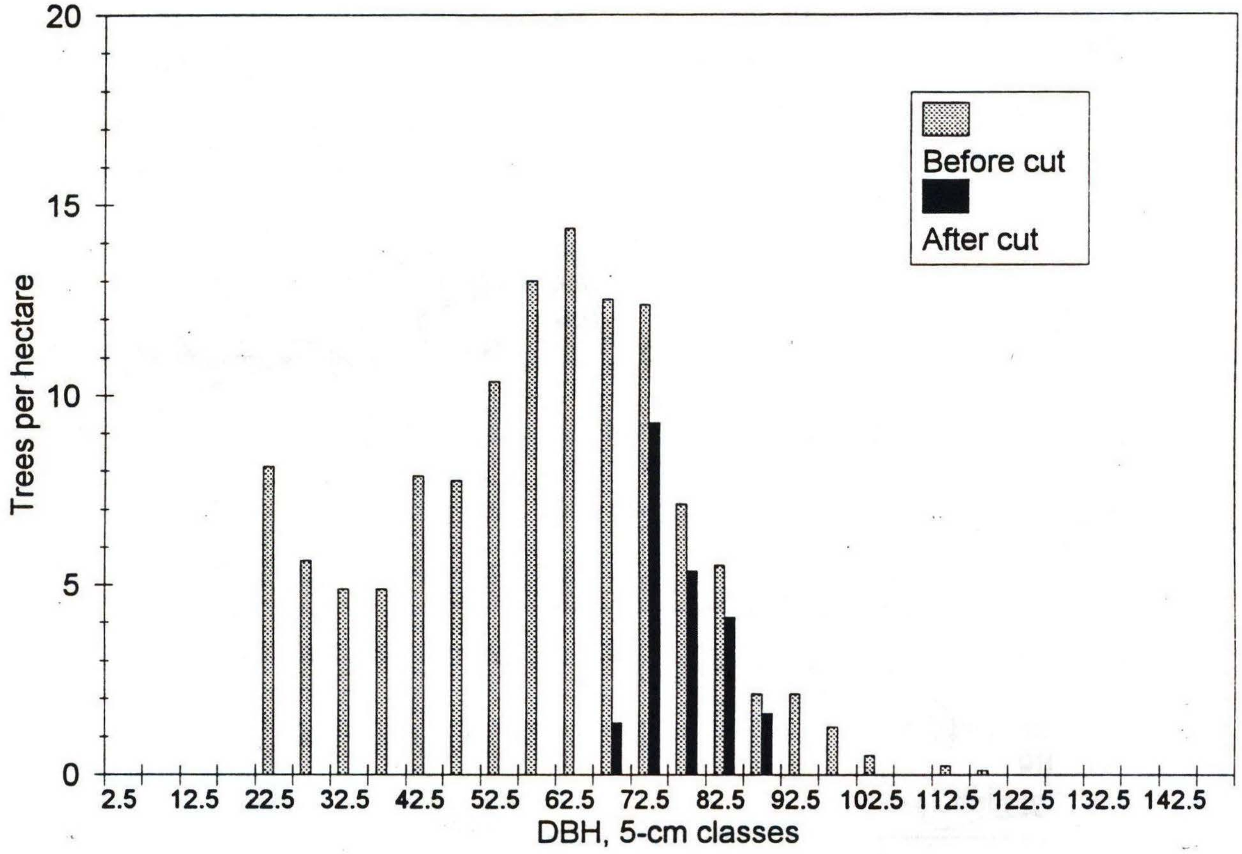


FIGURE 2, cont'd. Graphical distribution of before-cut and projected after-cut stand structure, based on application of the shelterwood method at CEF San Juan Tetla study area. Data are based on 100 percent inventory of eight 1.0-ha measurement plots. RBA=residual basal area; Dmax=maximum diameter retained. Filename: SWSJTMET.WB1.

B Moderate shelterwood (RBA=15 m^2/ha, 75% retained by class, Dmax=90 cm)

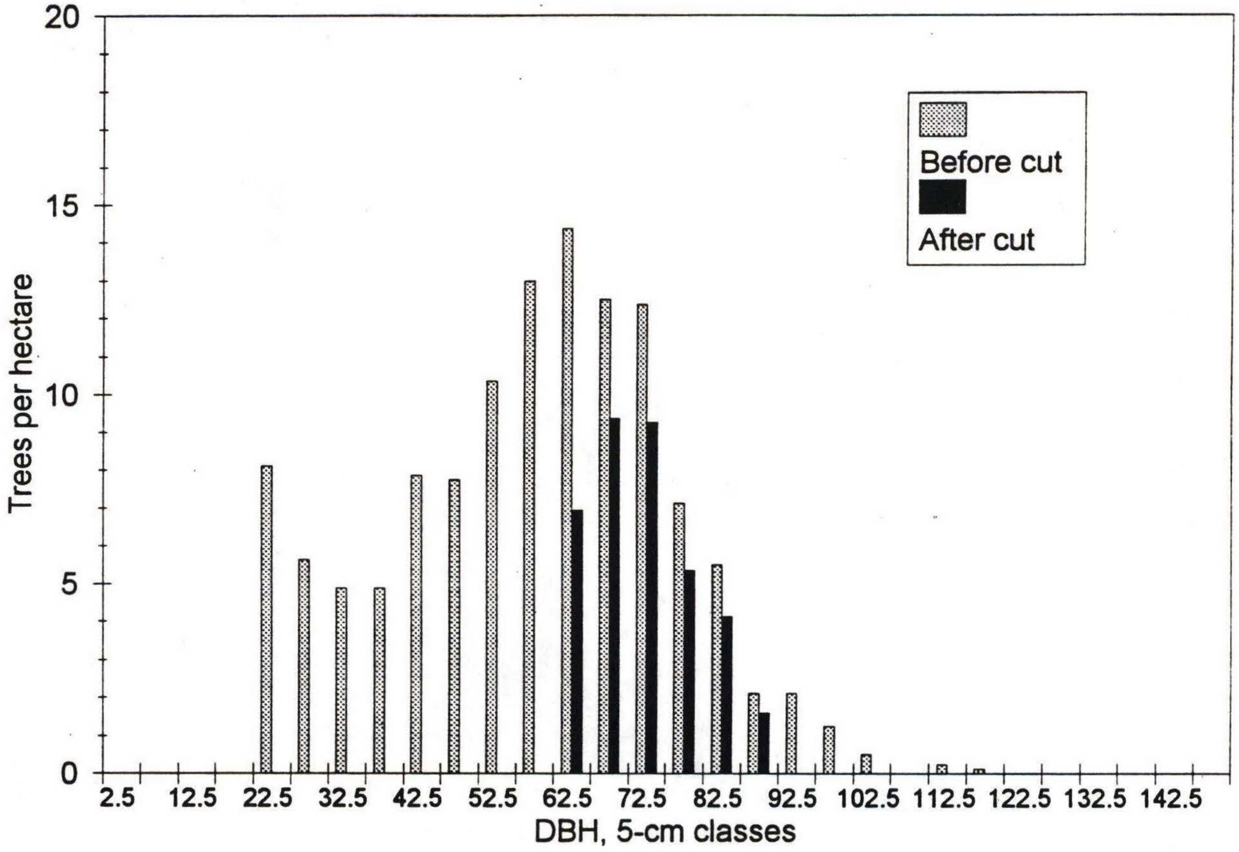


FIGURE 2, cont'd. Graphical distribution of before-cut and projected after-cut stand structure, based on application of the shelterwood method at CEF San Juan Tetla study area. Data are based on 100 percent inventory of eight 1.0-ha measurement plots. RBA=residual basal area; Dmax=maximum diameter retained. Filename: SWSJTMET.WB1.

C. Heavy shelterwood (RBA=20 m^2/ha, 80% retained by class, Dmax=90 cm)

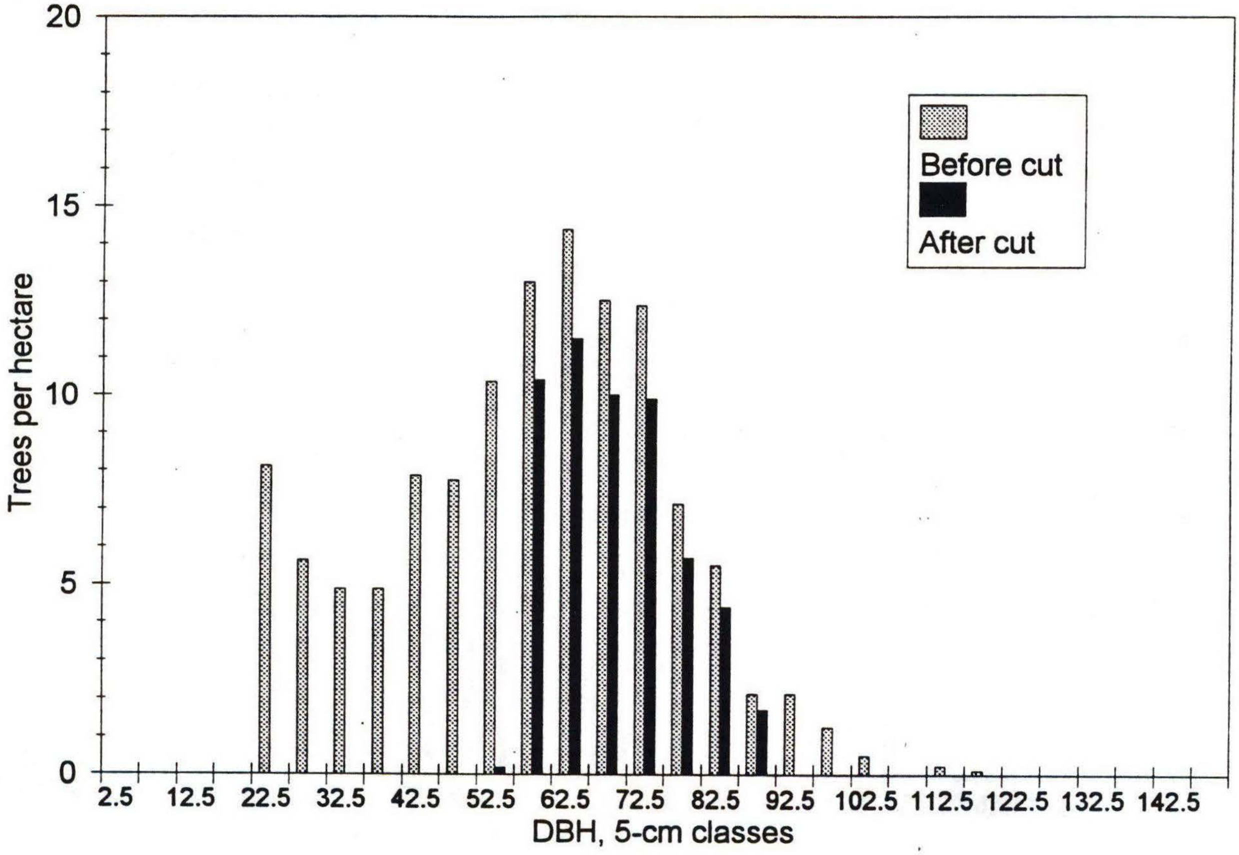


FIGURE 2, cont'd. Graphical distribution of before-cut and projected after-cut stand structure, based on application of the shelterwood method at CEF San Juan Tetla study area. Data are based on 100 percent inventory of eight 1.0-ha measurement plots. RBA=residual basal area; Dmax=maximum diameter retained. Filename: SWSJTMET.WB1.

D Maximum shelterwood (RBA=25 m^2/ha, 80% retained by class, Dmax=100 cm)

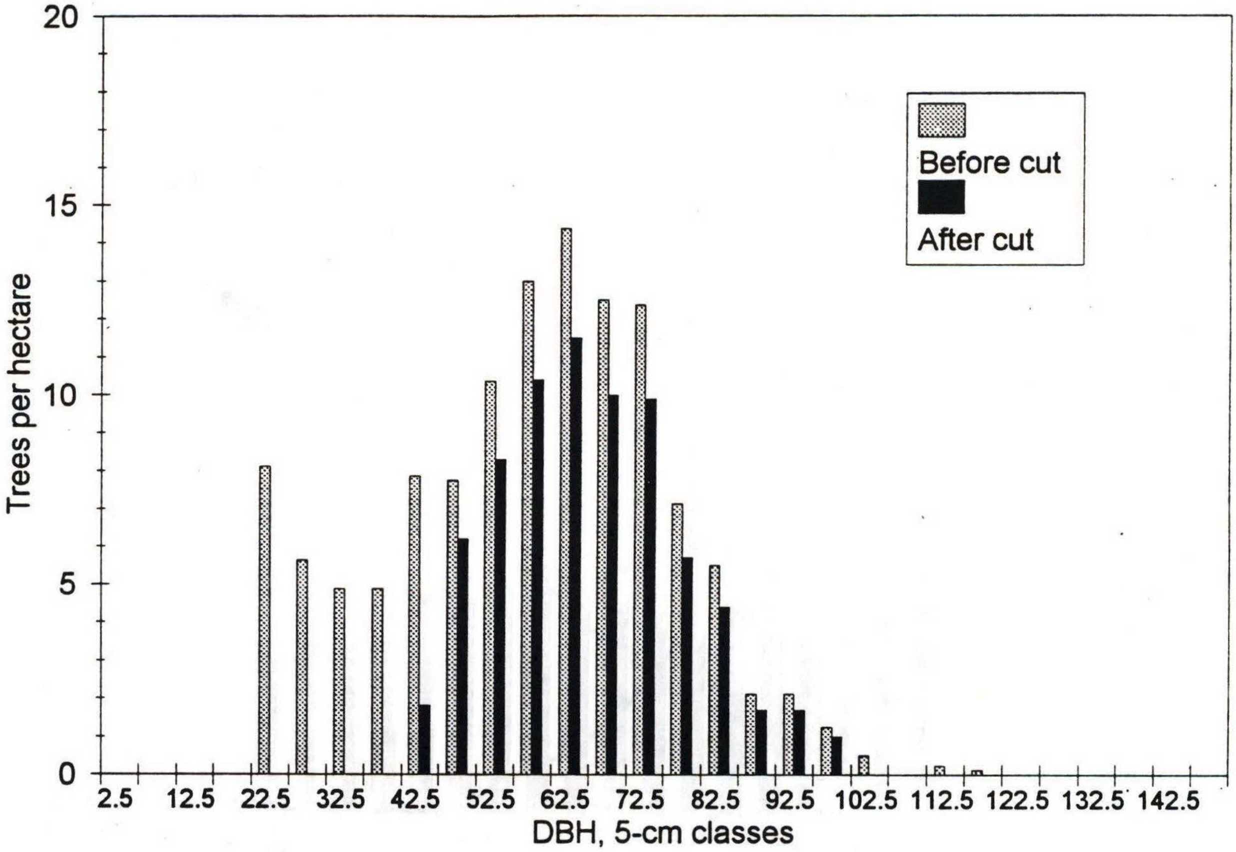


FIGURE 3. Graphical distribution of before-cut and projected after-cut stand structure, based on application of the single-tree selection method at CEF San Juan Tetla study area. Data are based on 100 percent inventory of eight 1.0-ha measurement plots. B=residual basal area; D=maximum diameter retained; q=q ratio for 5-cm diameter classes.
Filename: BDQSJTM.WB1.

A. Light BDq (B=18 m²/ha, D=77.5 cm, q=1.44)

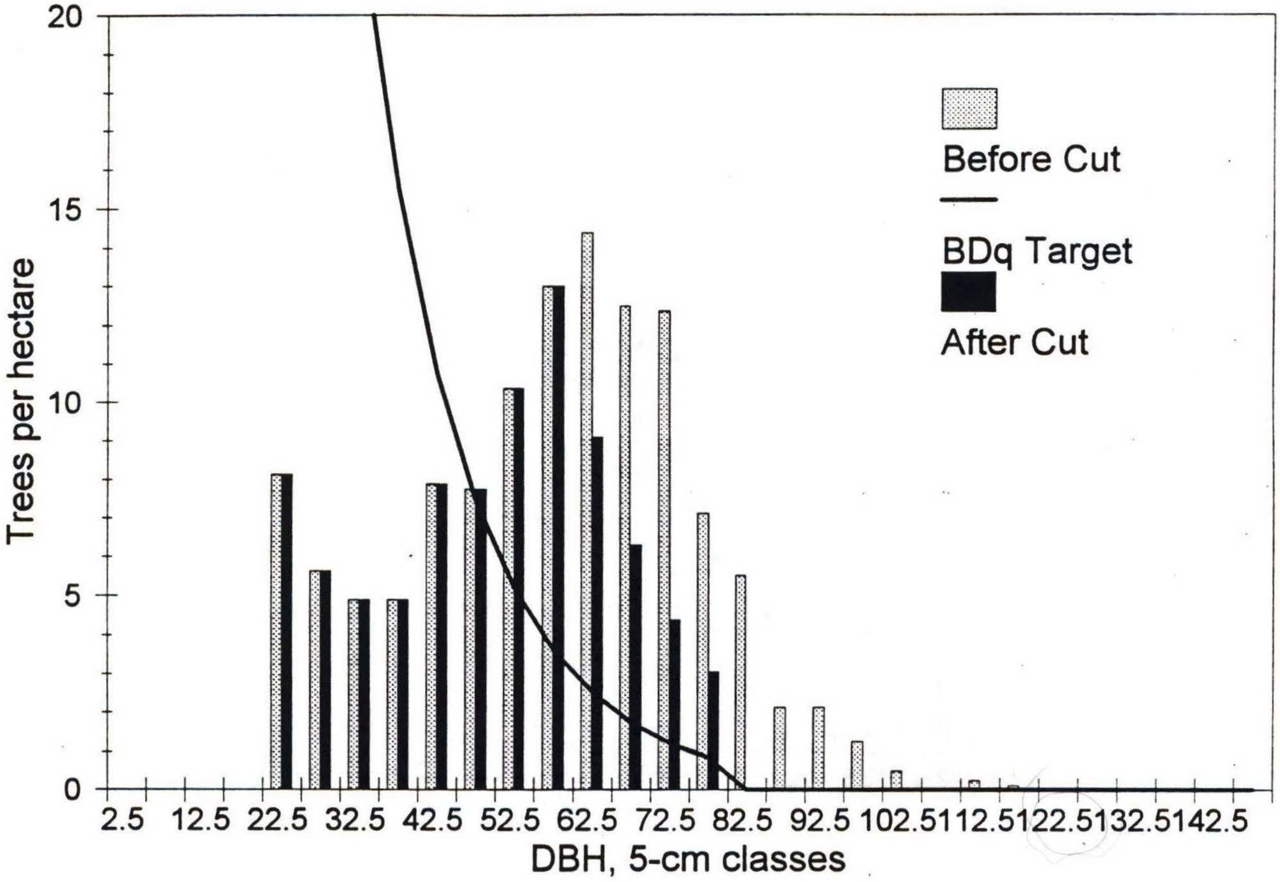


FIGURE 3, cont'd. Graphical distribution of before-cut and projected after-cut stand structure, based on application of the single-tree selection method at CEF San Juan Tetla study area. Data are based on 100 percent inventory of eight 1.0-ha measurement plots. B=residual basal area; D=maximum diameter retained; q=q ratio for 5-cm diameter classes.
Filename: BDQSJTM.WB1.

B Moderate BDq (B=21 m²/ha, D=87.5 cm; q=1.21)

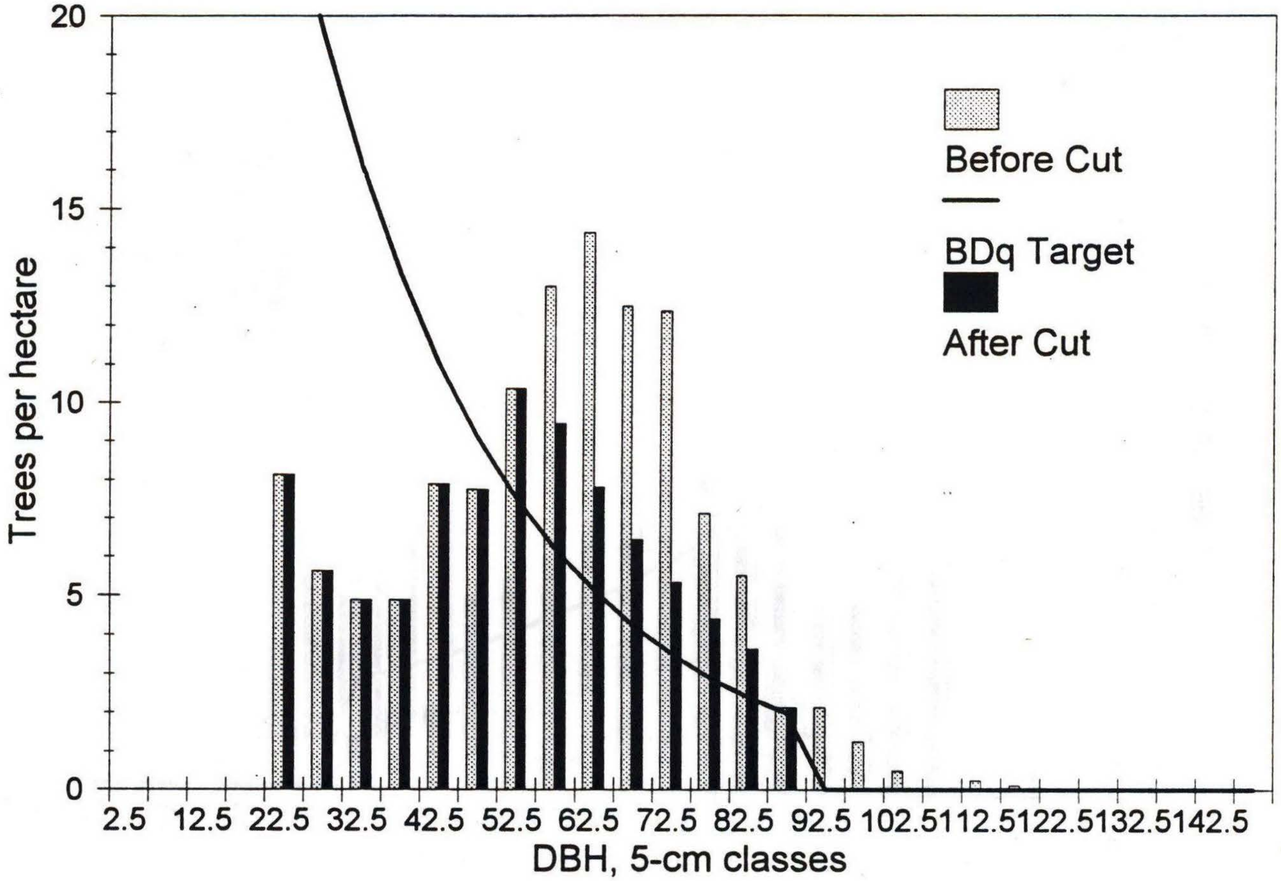


FIGURE 3, cont'd. Graphical distribution of before-cut and projected after-cut stand structure, based on application of the single-tree selection method at CEF San Juan Tetla study area. Data are based on 100 percent inventory of eight 1.0-ha measurement plots. B=residual basal area; D=maximum diameter retained; q=q ratio for 5-cm diameter classes. Filename: BDQSJTM.WB1.

C. Heavy BDq (B=24 m^2/ha, D=97.5 cm, q=1.10)

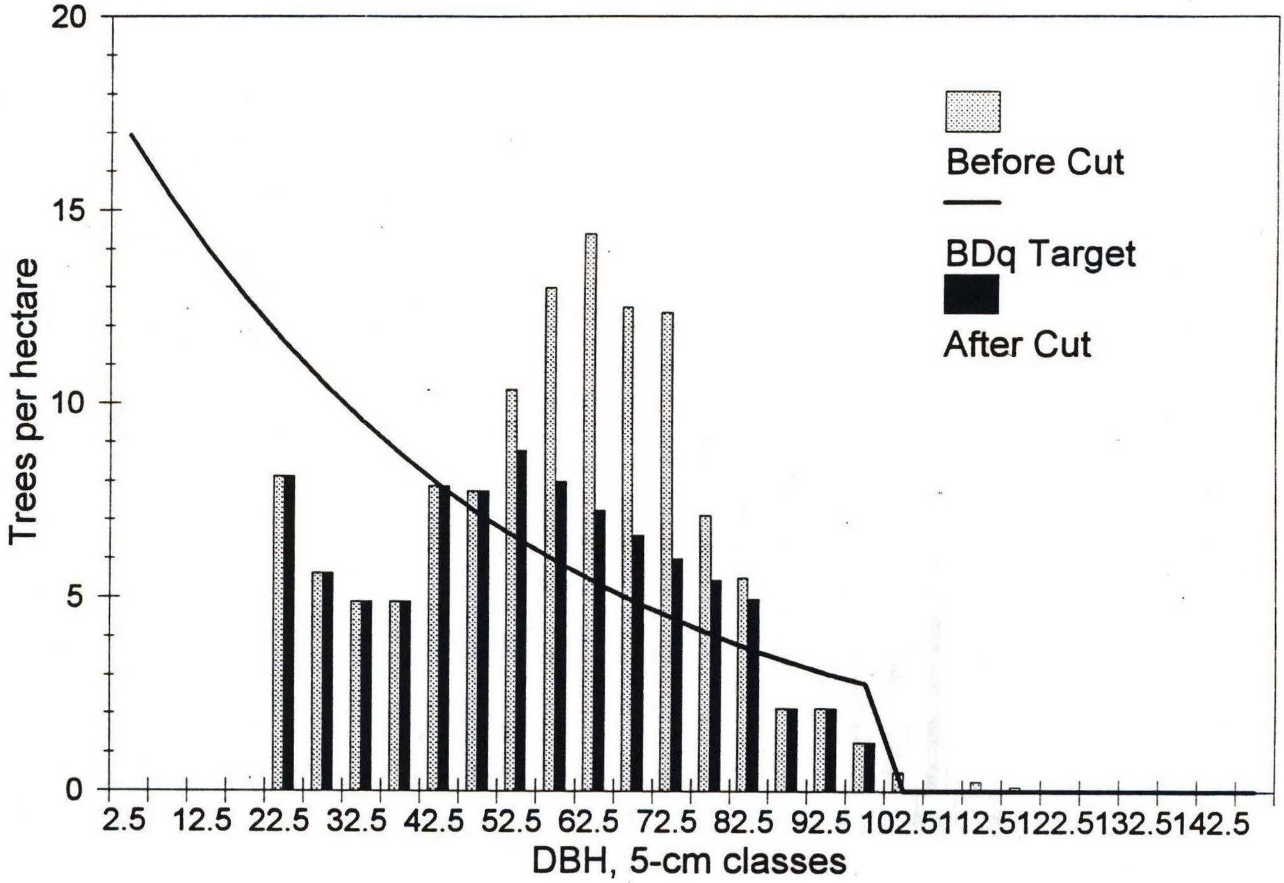


FIGURE 4. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies and hardwoods (hojosas) at CEF San Juan Tetla study area. Data based on 100 percent inventory of eight 1.0-ha measurement plots.
Filename: SJTDD.WB1, page all

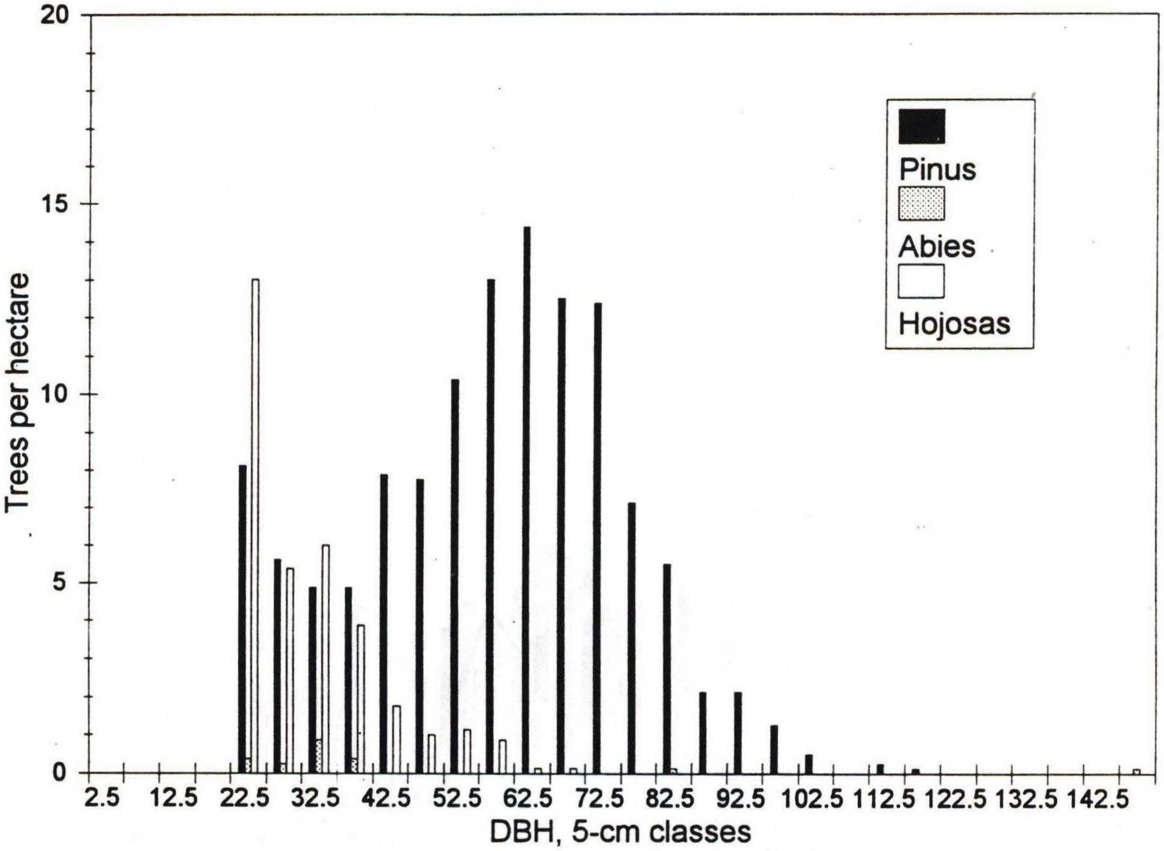


FIGURE 5. Heavy shelterwood treatment, Plot 1.

a. Target residual tree marking tally versus final tally for both the 1-ha measurement plot and the 3-ha buffer plot. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.

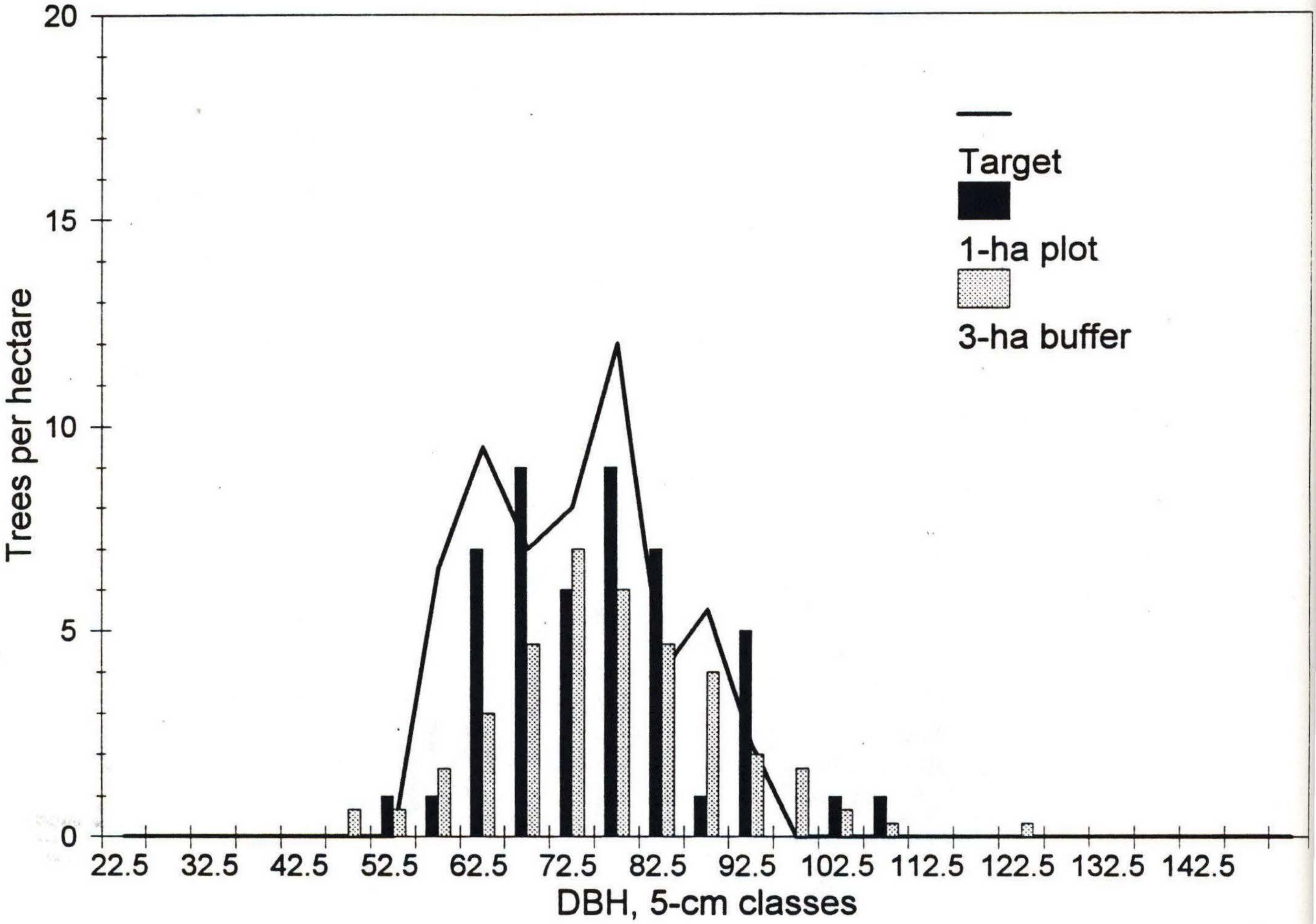


FIGURE 5, cont'd. Heavy shelterwood treatment, plot 1.

b. Preharvest diameter distribution, target residual tree marking tally, and final tally for the 4-ha treatment plot. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.

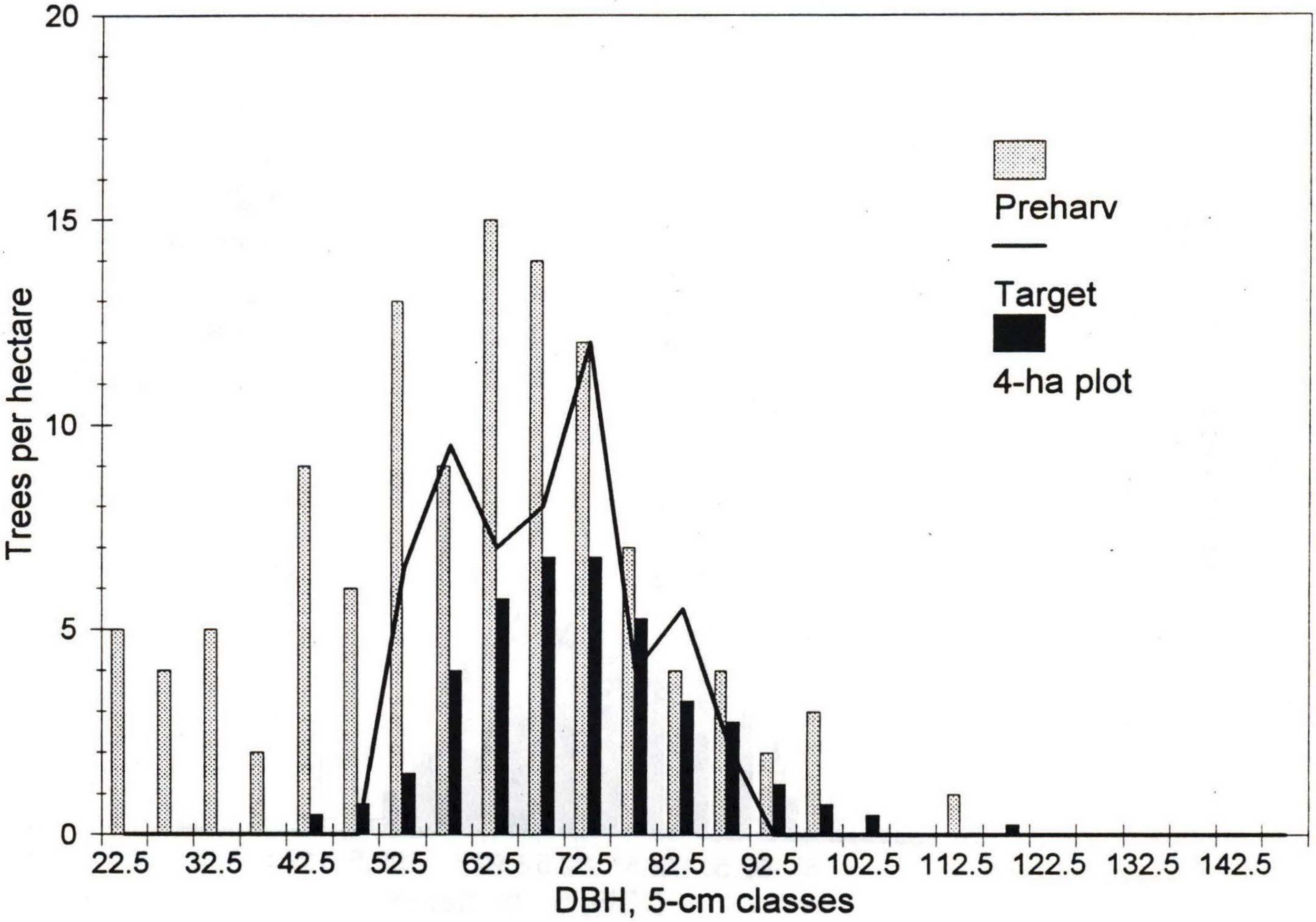


FIGURE 6. Heavy shelterwood treatment, Plot 4.

a. Target residual tree marking tally versus final tally for both the 1-ha measurement plot and the 3-ha buffer plot. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.

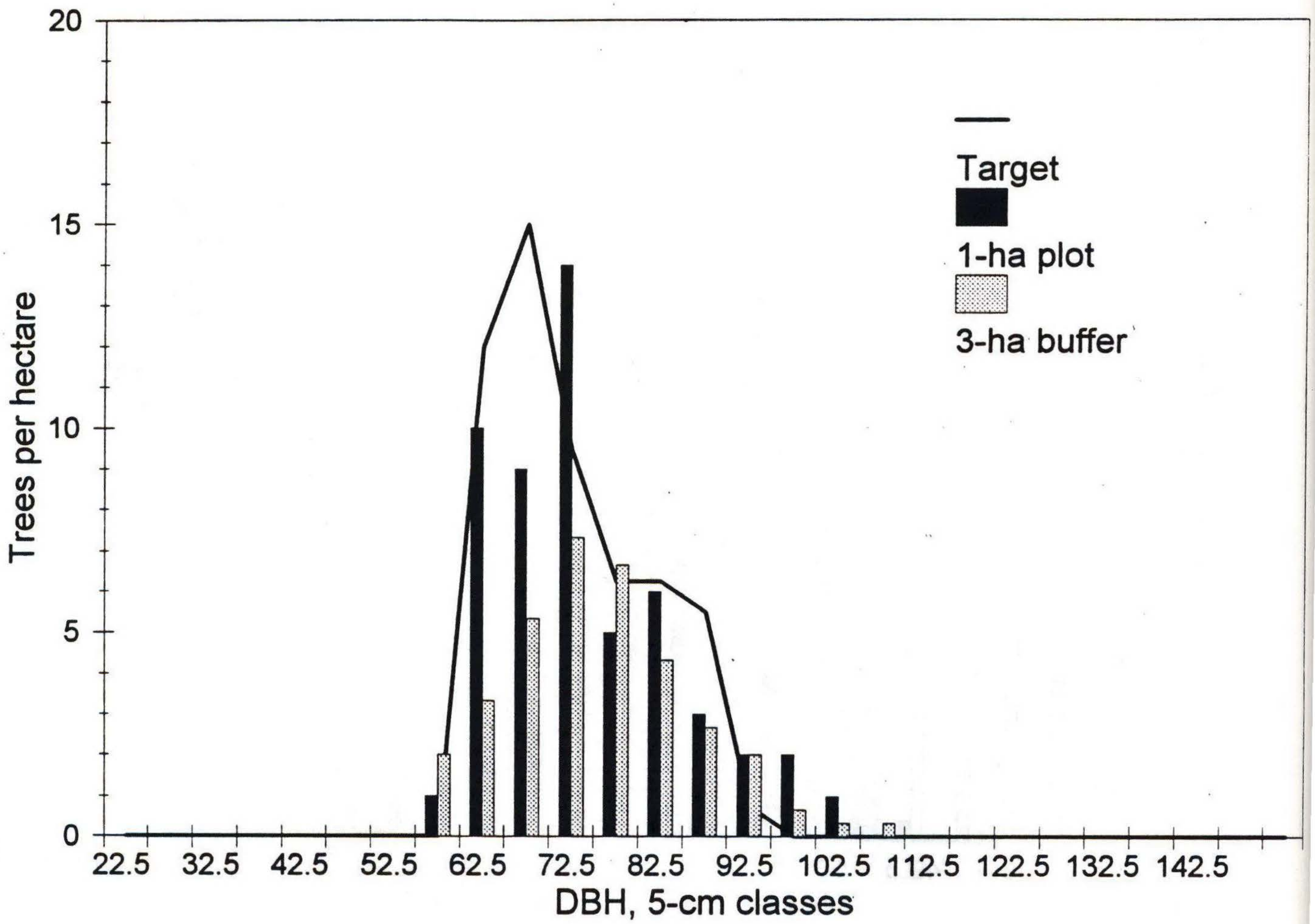


FIGURE 6, cont'd. Heavy shelterwood treatment, plot 4.

b. Preharvest diameter distribution, target residual tree marking tally, and final tally for the 4-ha treatment plot. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.

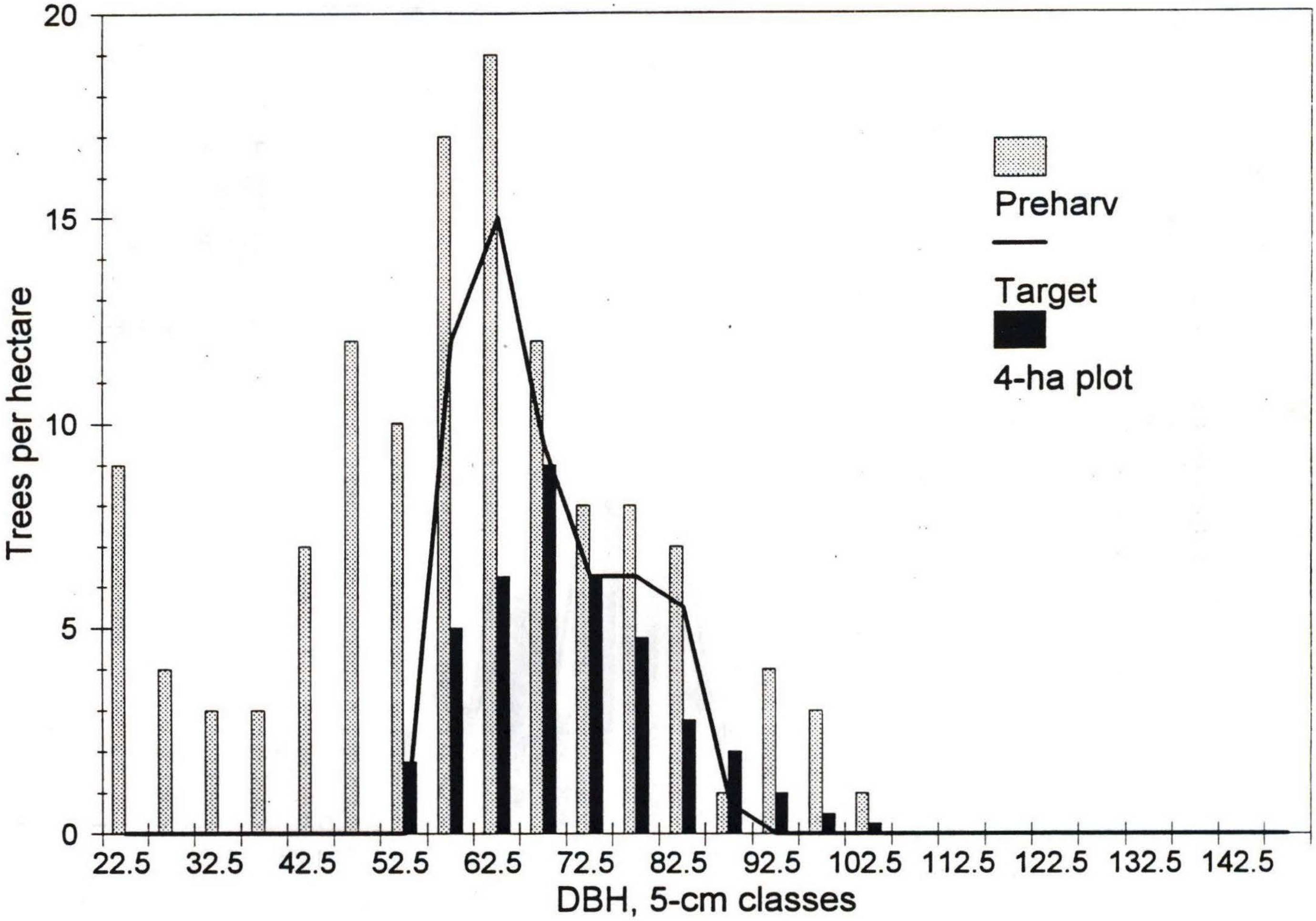


FIGURE 7. Moderate shelterwood treatment, Plot 2.

a. Target residual tree marking tally versus final tally for both the 1-ha measurement plot and the 3-ha buffer plot. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.

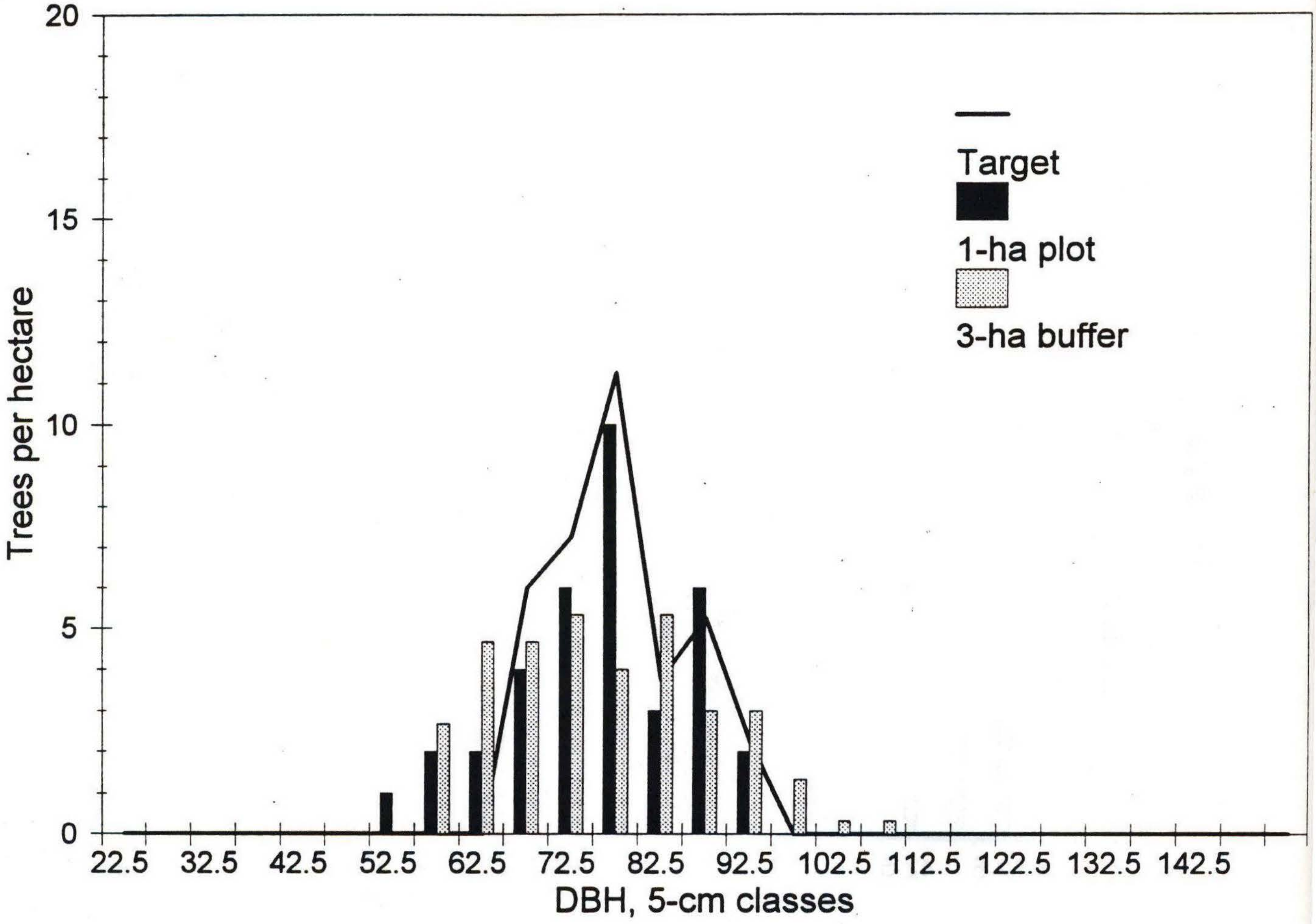


FIGURE 7, cont'd. Moderate shelterwood treatment, plot 2.

b. Preharvest diameter distribution, target residual tree marking tally, and final tally for the 4-ha treatment plot. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.

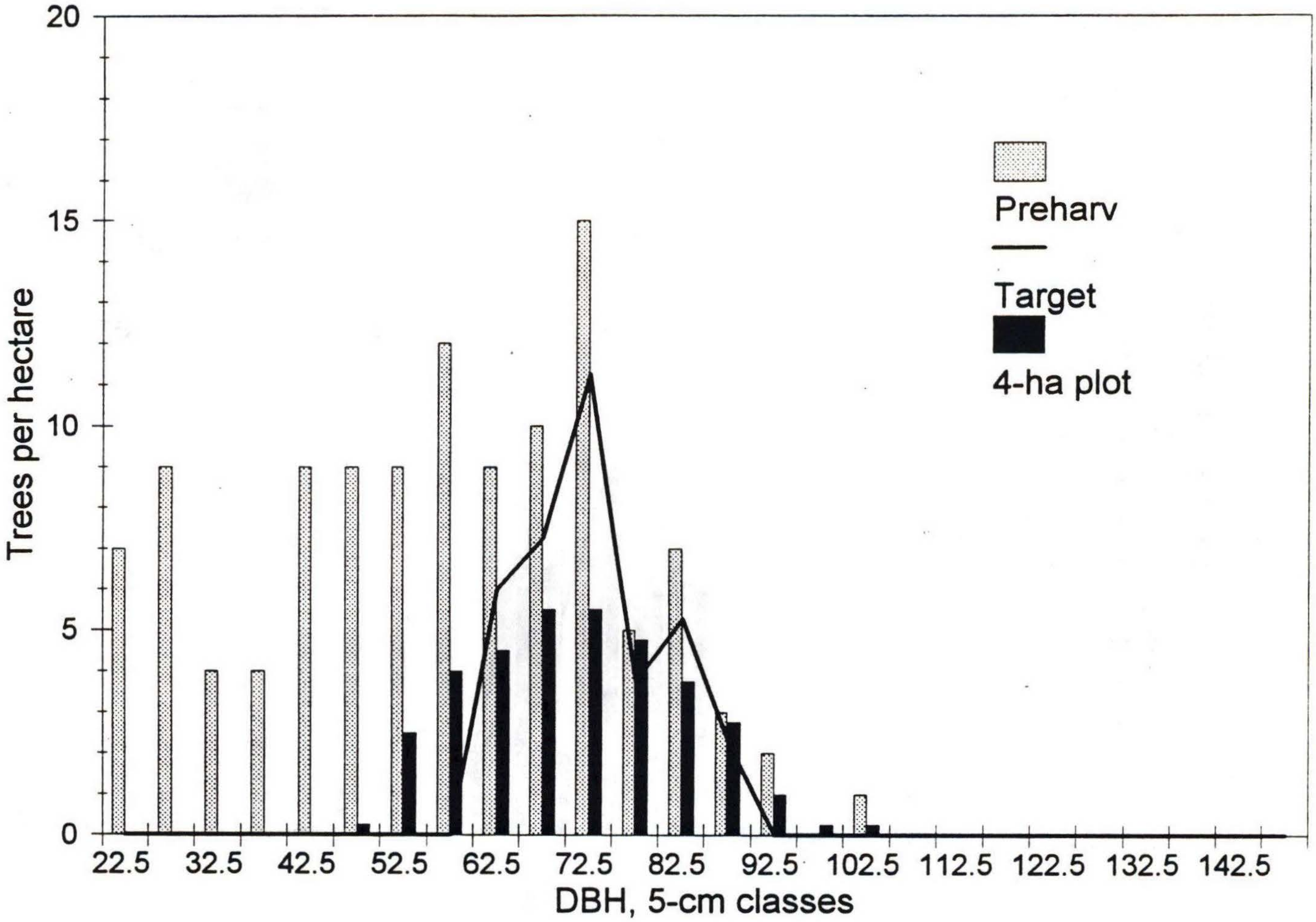


FIGURE 8. Moderate shelterwood treatment, Plot 3.

a. Target residual tree marking tally versus final tally for both the 1-ha measurement plot and the 3-ha buffer plot. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.

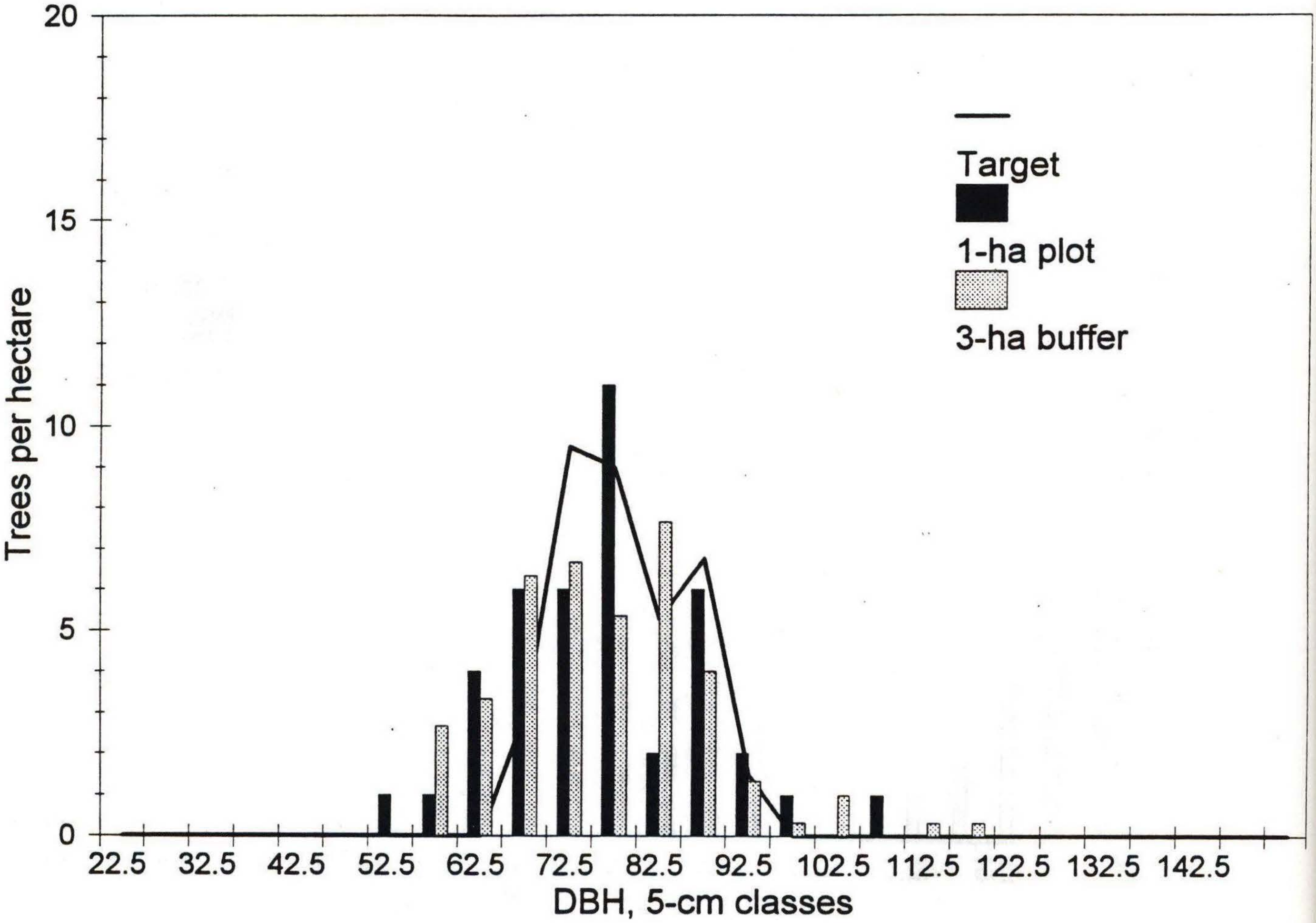


FIGURE 8, cont'd. Moderate shelterwood treatment, plot 3.

b. Preharvest diameter distribution, target residual tree marking tally, and final tally for the 4-ha treatment plot. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.

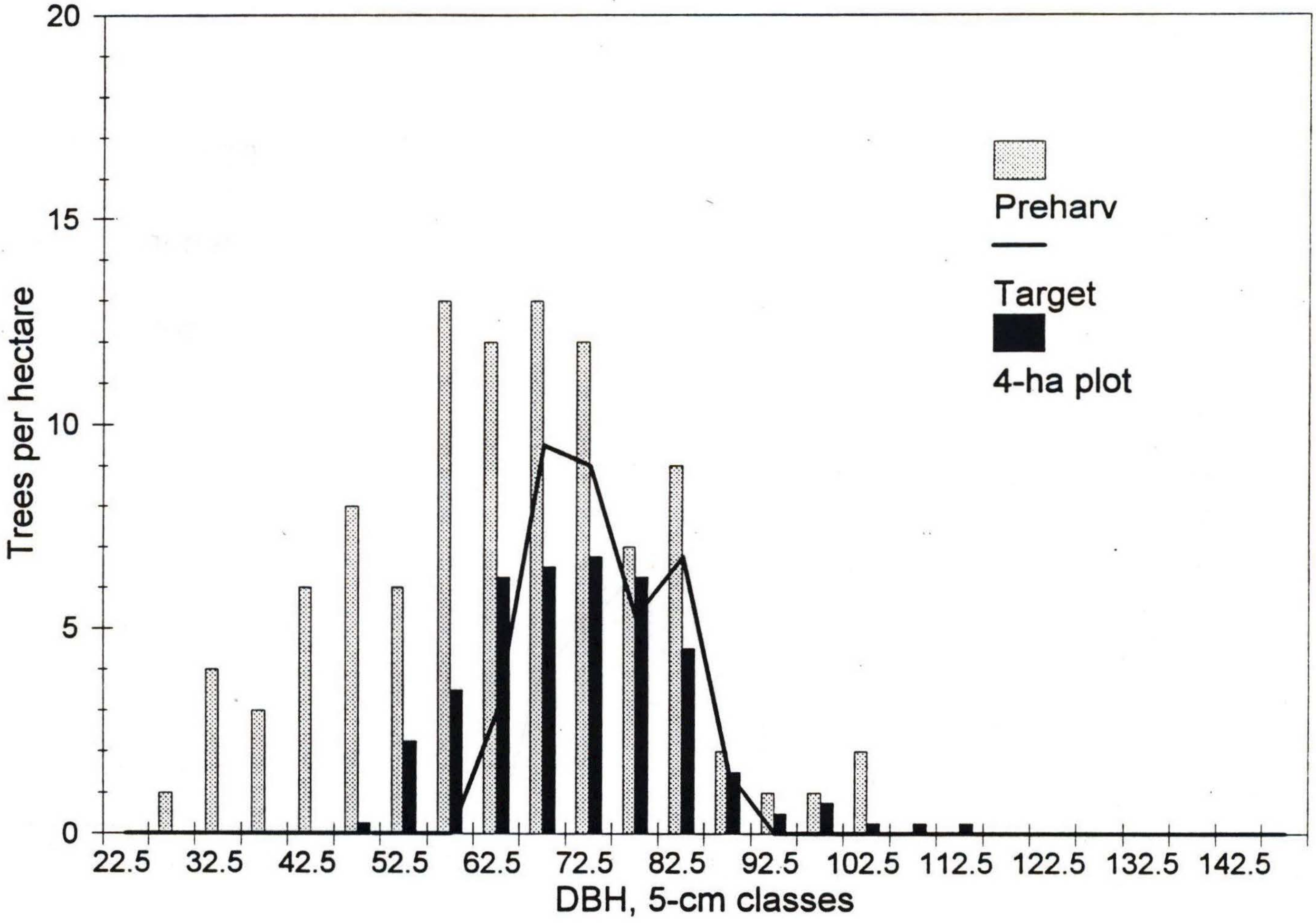


FIGURE 9 Marking accuracy, moderate BDq single-tree selection treatment, Plot 6.

a. BDq structure, preharvest diameter distribution, and target marking tally. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.

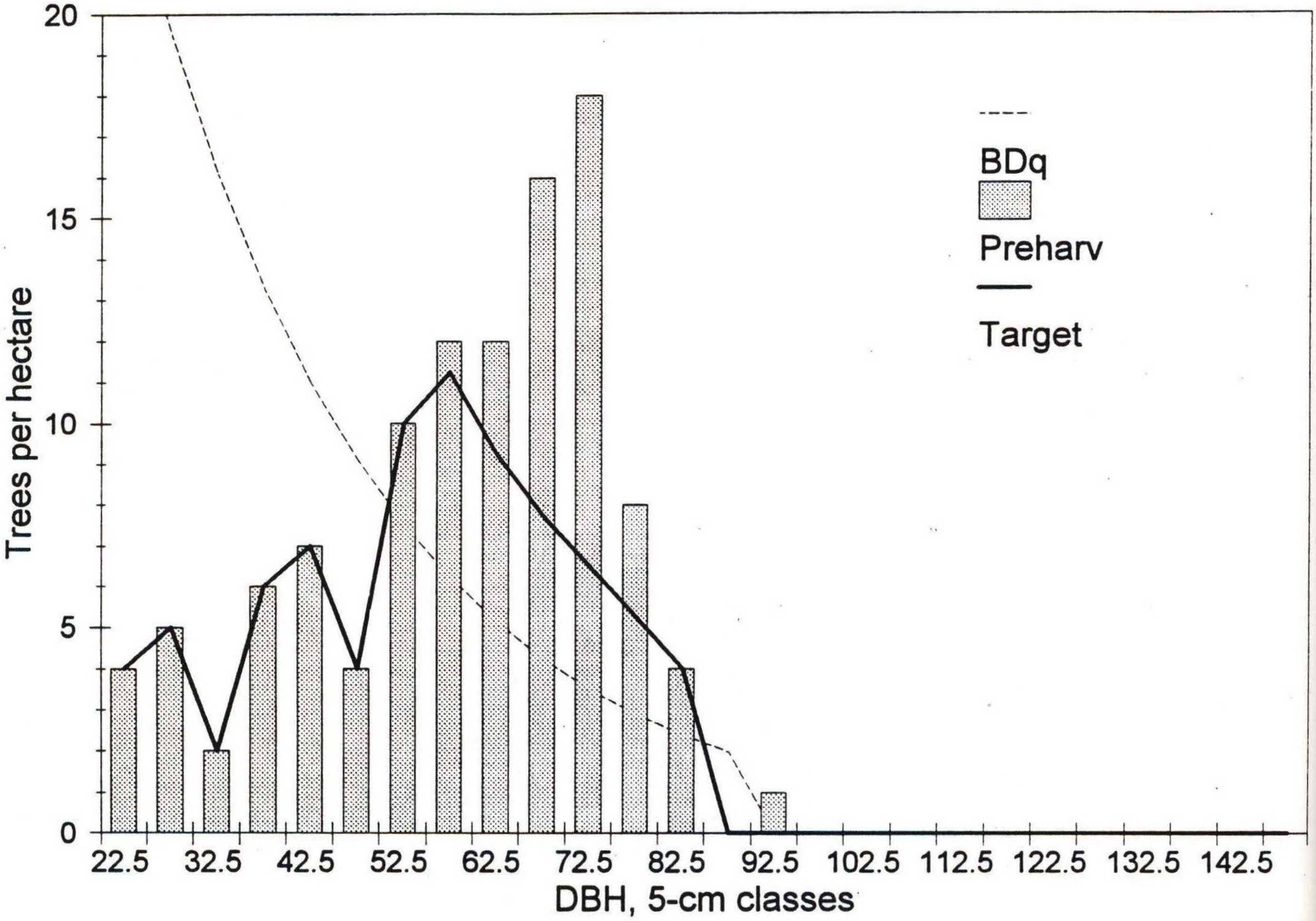


FIGURE 9, cont'd. Marking accuracy, moderate BDq single-tree selection treatment, Plot 6.

b. Target residual tree marking tally versus final tally for both the 1-ha measurement plot and the 3-ha buffer plot. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.

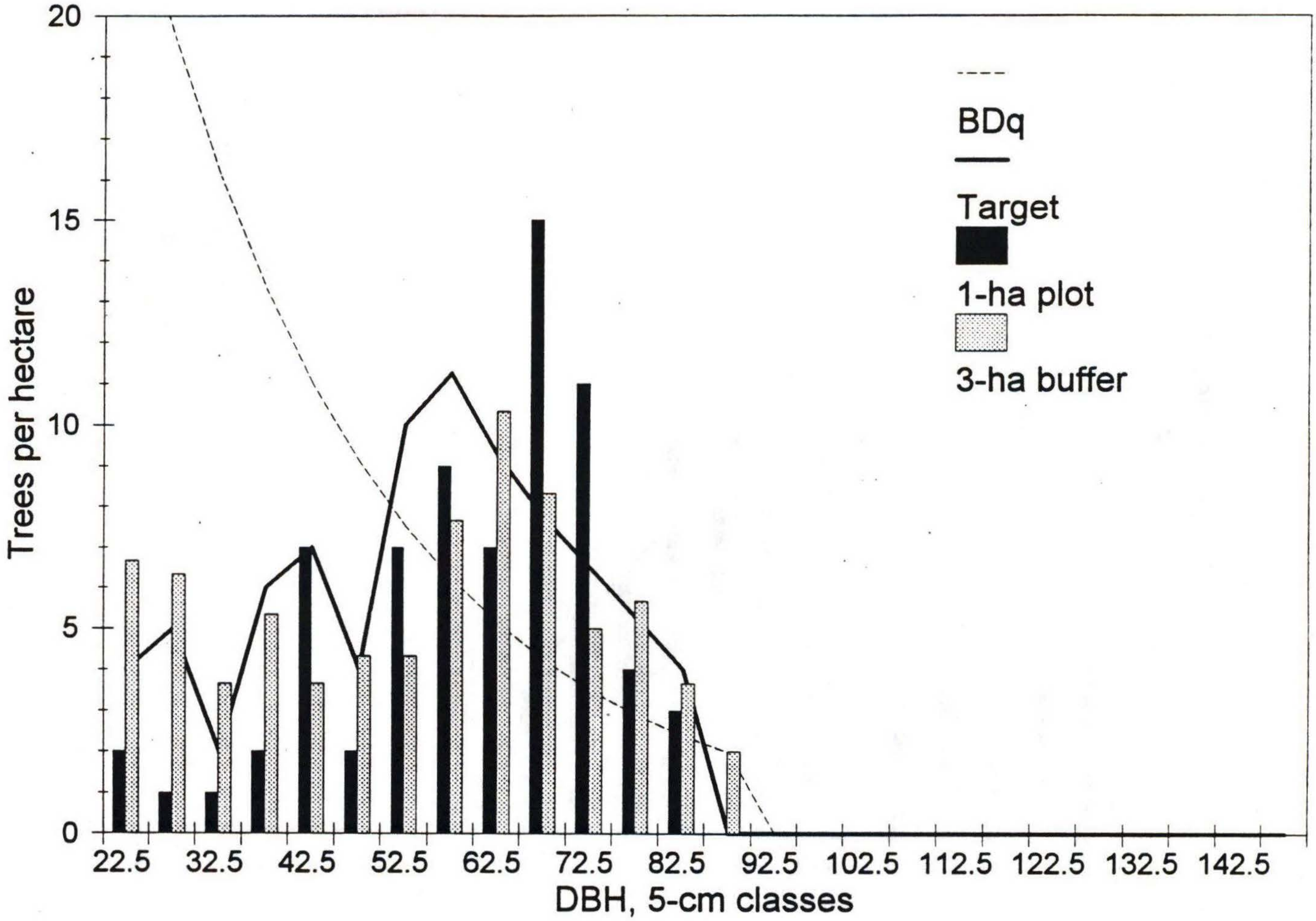


FIGURE 9, cont'd. Marking accuracy. moderate BDq single-tree selection treatment, Plot 6.

c. Preharvest diameter distribution, target residual tree marking tally, and final tally for the 4-ha treatment plot. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.

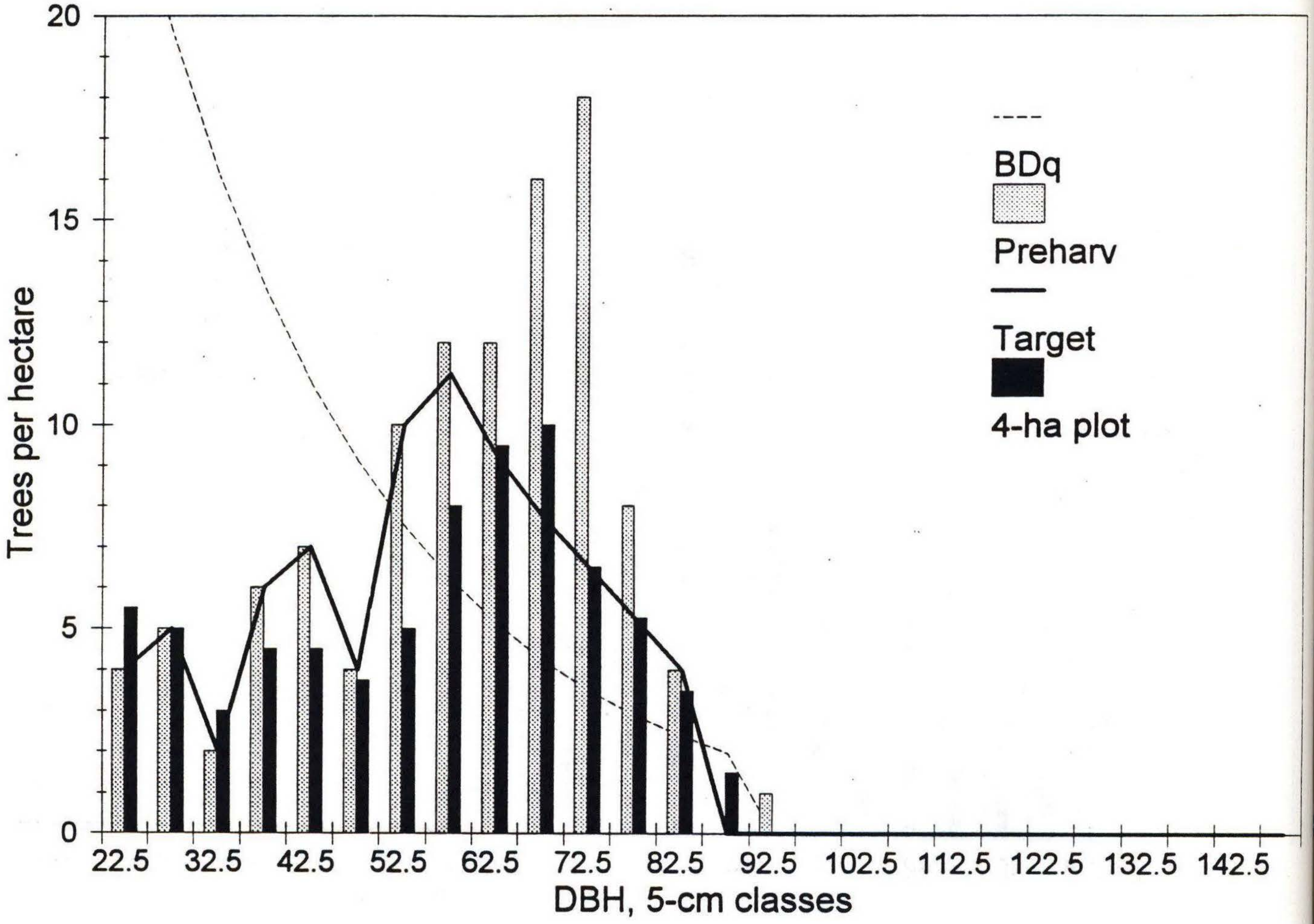


FIGURE 10. Marking accuracy, moderate BDq single-tree selection treatment, Plot 8.

a. BDq structure, preharvest diameter distribution, and target marking tally. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.

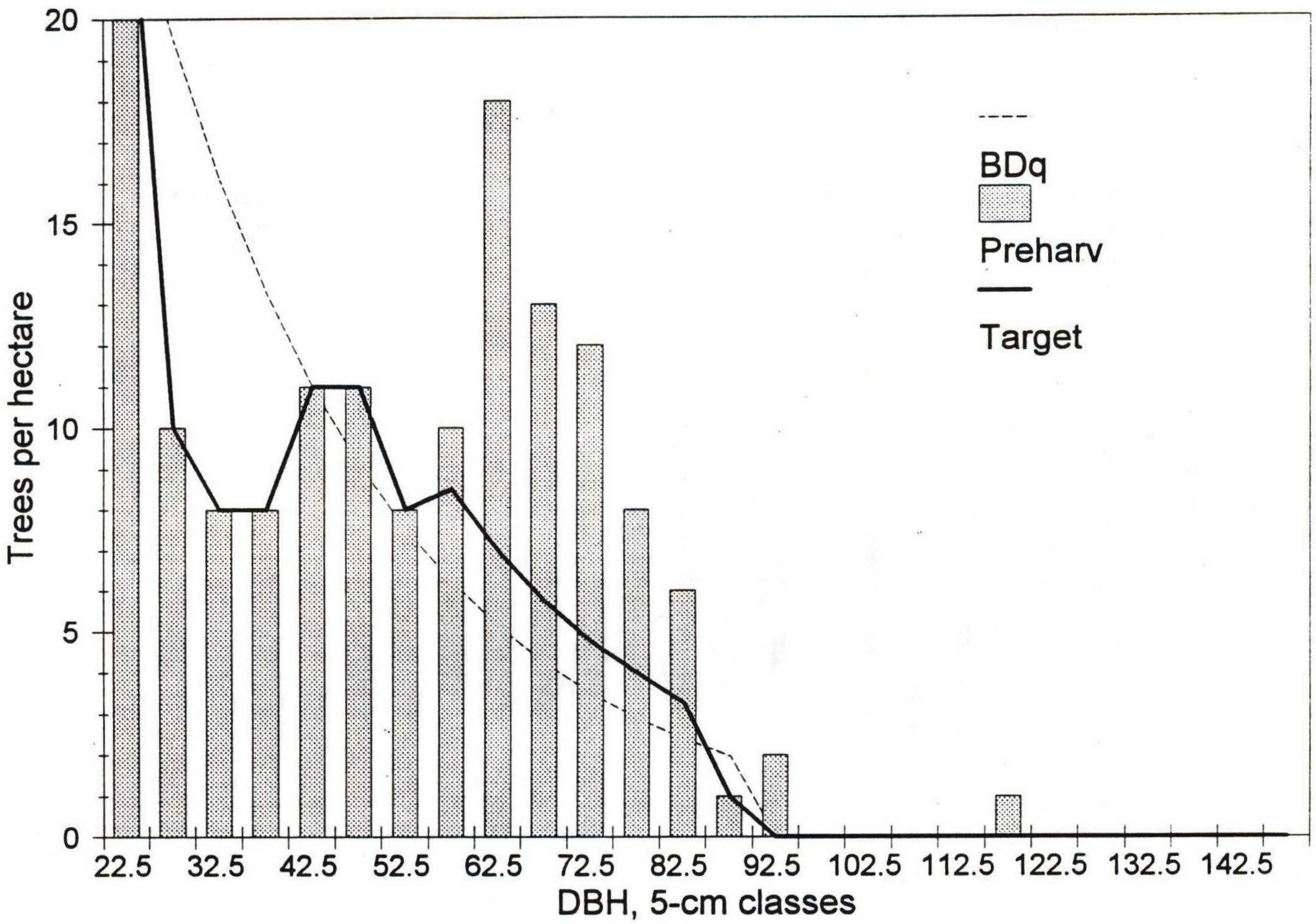


FIGURE 10, cont'd. Marking accuracy, moderate BDq single-tree selection treatment, Plot 8.

b. Target residual tree marking tally versus final tally for both the 1-ha measurement plot and the 3-ha buffer plot. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.

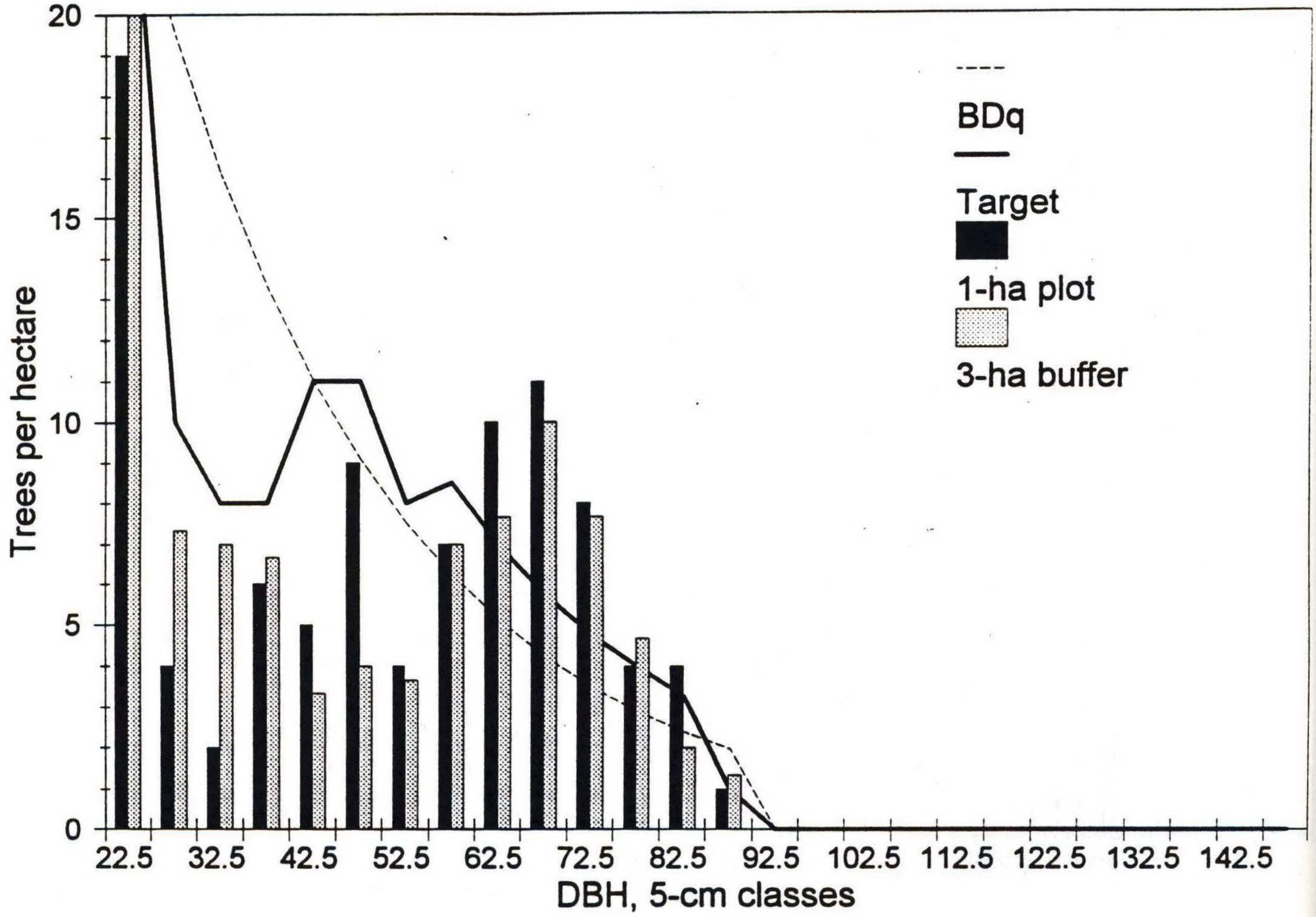
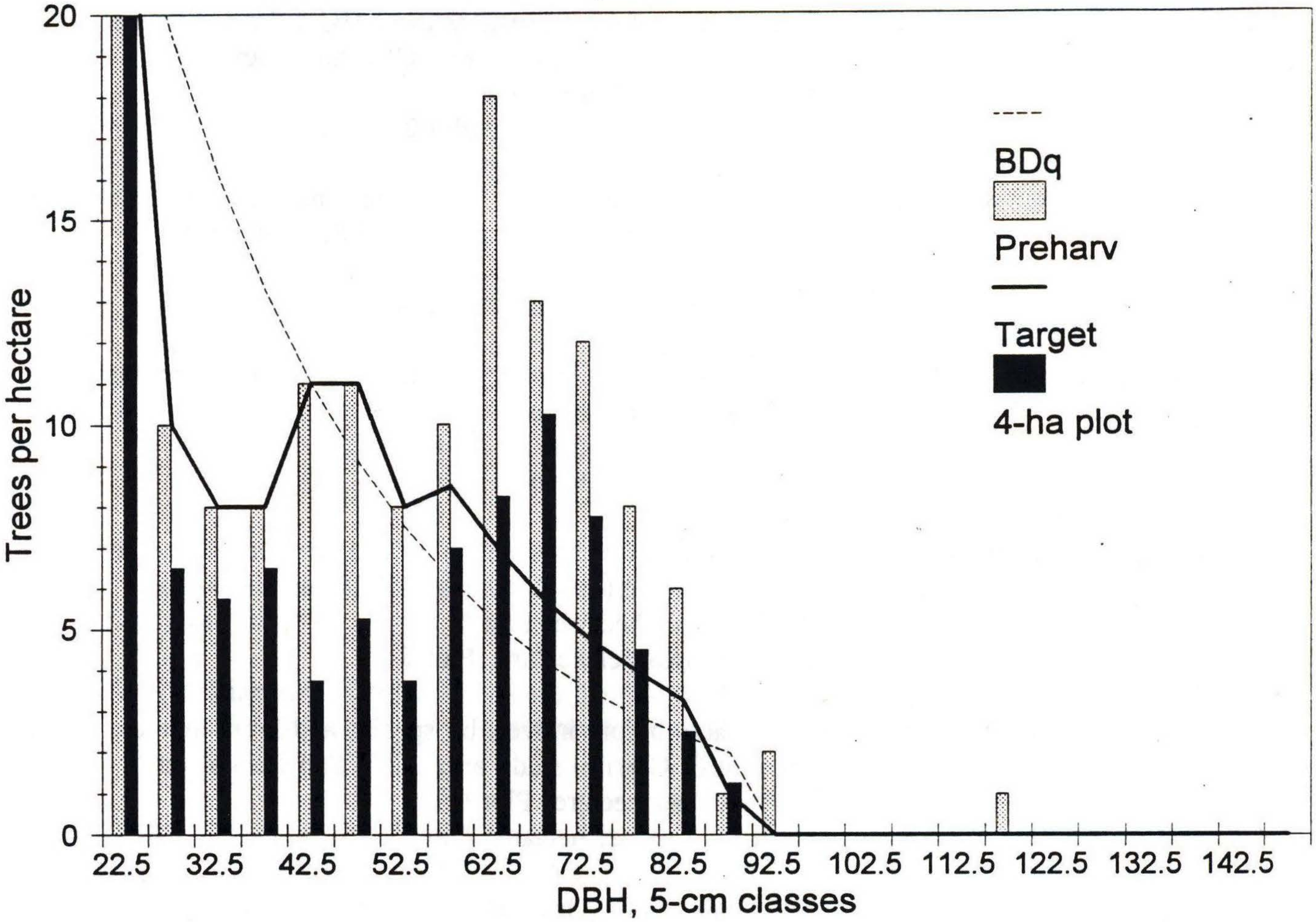


FIGURE 10, cont'd. Marking accuracy, moderate BDq single-tree selection treatment, Plot 8.

c. Preharvest diameter distribution, target residual tree marking tally, and final tally for the 4-ha treatment plot. All data expressed by 5-cm diameter classes on a unitary (trees per hectare) basis. Filename: TRTSUMM.WB1.



APPENDIX: LIST OF TABLES AND FIGURES

APPENDIX TABLE 1. Stand table before harvest by species and 5-cm diameter classes for Plot 1, Carrillo study area, CEF San Juan Tetla.
A. Trees per hectare, Plot 1
B. Basal area per hectare, Plot 1

APPENDIX TABLE 2. Stand table before harvest by species and 5-cm diameter classes for Plot 2, Carrillo study area, CEF San Juan Tetla.
A. Trees per hectare, Plot 2
B. Basal area per hectare, Plot 2

APPENDIX TABLE 3. Stand table before harvest by species and 5-cm diameter classes for Plot 3, Carrillo study area, CEF San Juan Tetla.
A. Trees per hectare, Plot 3
B. Basal area per hectare, Plot 3

APPENDIX TABLE 4. Stand table before harvest by species and 5-cm diameter classes for Plot 4, Carrillo study area, CEF San Juan Tetla.
A. Trees per hectare, Plot 4
B. Basal area per hectare, Plot 4

APPENDIX TABLE 5. Stand table before harvest by species and 5-cm diameter classes for Plot 5, Carrillo study area, CEF San Juan Tetla.
A. Trees per hectare, Plot 5
B. Basal area per hectare, Plot 5

APPENDIX TABLE 6. Stand table before harvest by species and 5-cm diameter classes for Plot 6, Carrillo study area, CEF San Juan Tetla.
A. Trees per hectare, Plot 6
B. Basal area per hectare, Plot 6

APPENDIX TABLE 7. Stand table before harvest by species and 5-cm diameter classes for Plot 7, Carrillo study area, CEF San Juan Tetla.
A. Trees per hectare, Plot 7
B. Basal area per hectare, Plot 7

APPENDIX TABLE 8. Stand table before harvest by species and 5-cm diameter classes for Plot 8, Carrillo study area, CEF San Juan Tetla.
A. Trees per hectare, Plot 8
B. Basal area per hectare, Plot 8

APPENDIX: LIST OF TABLES AND FIGURES, cont'd.

FIGURE A1. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 1, CEF San Juan Tetla study area.

FIGURE A2. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 2, CEF San Juan Tetla study area.

FIGURE A3. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 3, CEF San Juan Tetla study area.

FIGURE A4. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 4, CEF San Juan Tetla study area.

FIGURE A5. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 5, CEF San Juan Tetla study area.

FIGURE A6. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 6, CEF San Juan Tetla study area.

FIGURE A7. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 7, CEF San Juan Tetla study area.

FIGURE A8. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 8, CEF San Juan Tetla study area.

APPENDIX TABLE 1. Stand table before harvest by species and 5-cm diameter classes for Plot 1, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

A. Trees per hectare, Plot 1

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	4.0	1.0	0.0	1.0	10.0	3.0	0.0	2.0	21.0
27.5	3.0	1.0	0.0	0.0	3.0	1.0	0.0	1.0	9.0
32.5	5.0	0.0	0.0	0.0	15.0	0.0	0.0	0.0	20.0
37.5	2.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0
42.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
47.5	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
52.5	13.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	15.0
57.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
62.5	14.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0
67.5	13.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0
72.5	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
77.5	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
82.5	4.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	5.0
87.5	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
92.5	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
97.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
102.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
107.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
112.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
117.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
122.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
127.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
132.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
137.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
142.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
147.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	110.0	5.0	0.0	2.0	29.0	4.0	0.0	5.0	155.0

APPENDIX TABLE 1, cont'd. Stand table before harvest by species and 5-cm diameter classes for Plot 1, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

B. Basal area per hectare, Plot 1

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	0.16	0.04	0.00	0.04	0.40	0.12	0.00	0.08	0.83
27.5	0.18	0.06	0.00	0.00	0.18	0.06	0.00	0.06	0.53
32.5	0.41	0.00	0.00	0.00	1.24	0.00	0.00	0.00	1.66
37.5	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.33
42.5	1.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.28
47.5	1.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06
52.5	2.81	0.00	0.00	0.00	0.22	0.00	0.00	0.22	3.25
57.5	2.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.34
62.5	4.30	0.31	0.00	0.00	0.00	0.00	0.00	0.00	4.60
67.5	4.65	0.36	0.00	0.00	0.00	0.00	0.00	0.00	5.01
72.5	4.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.95
77.5	3.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.30
82.5	2.14	0.00	0.00	0.53	0.00	0.00	0.00	0.00	2.67
87.5	2.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.41
92.5	1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.34
97.5	2.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.24
102.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
107.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112.5	0.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.99
117.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
122.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
127.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
132.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
137.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
142.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
147.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	33.79	1.76	0.00	0.57	2.04	0.18	0.00	0.47	38.81

APPENDIX TABLE 2. Stand table before harvest by species and 5-cm diameter classes for Plot 2, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

A. Trees per hectare, Plot 2

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	7.0	0.0	0.0	0.0	5.0	2.0	0.0	0.0	14.0
27.5	9.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	15.0
32.5	4.0	0.0	0.0	0.0	5.0	1.0	0.0	0.0	10.0
37.5	4.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	6.0
42.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
47.5	9.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	10.0
52.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
57.5	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
62.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
67.5	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
72.5	13.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0
77.5	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
82.5	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
87.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
92.5	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
97.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
102.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
107.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
112.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
117.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
122.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
127.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
132.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
137.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
142.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
147.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	113.0	2.0	0.0	0.0	19.0	3.0	0.0	0.0	137.0

APPENDIX TABLE 2, cont'd. Stand table before harvest by species and 5-cm diameter classes for Plot 2, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

B. Basal area per hectare, Plot 2

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	0.28	0.00	0.00	0.00	0.20	0.08	0.00	0.00	0.56
27.5	0.53	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.89
32.5	0.33	0.00	0.00	0.00	0.41	0.08	0.00	0.00	0.83
37.5	0.44	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.66
42.5	1.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.28
47.5	1.59	0.00	0.00	0.00	0.18	0.00	0.00	0.00	1.77
52.5	1.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.95
57.5	3.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.12
62.5	2.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.76
67.5	3.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.58
72.5	5.37	0.83	0.00	0.00	0.00	0.00	0.00	0.00	6.19
77.5	2.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.36
82.5	3.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.74
87.5	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80
92.5	1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.34
97.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
102.5	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83
107.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
122.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
127.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
132.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
137.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
142.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
147.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	31.30	0.83	0.00	0.00	1.37	0.16	0.00	0.00	33.66

APPENDIX TABLE 3. Stand table before harvest by species and 5-cm diameter classes for Plot 3, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

A. Trees per hectare, Plot 3

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	0.0	0.0	0.0	0.0	5.0	7.0	0.0	0.0	12.0
27.5	0.0	1.0	0.0	0.0	3.0	0.0	0.0	0.0	4.0
32.5	2.0	2.0	0.0	1.0	8.0	0.0	0.0	0.0	13.0
37.5	2.0	0.0	1.0	1.0	6.0	0.0	0.0	0.0	10.0
42.5	6.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	10.0
47.5	8.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	9.0
52.5	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
57.5	13.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	16.0
62.5	12.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	13.0
67.5	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0
72.5	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
77.5	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
82.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
87.5	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
92.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
97.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
102.5	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
107.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
112.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
117.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
122.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
127.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
132.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
137.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
142.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
147.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	96.0	3.0	1.0	2.0	31.0	7.0	0.0	0.0	140.0

APPENDIX TABLE 3, cont'd. Stand table before harvest by species and 5-cm diameter classes for Plot 3, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

B. Basal area per hectare, Plot 3

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	0.00	0.00	0.00	0.00	0.20	0.28	0.00	0.00	0.48
27.5	0.00	0.06	0.00	0.00	0.18	0.00	0.00	0.00	0.24
32.5	0.17	0.17	0.00	0.08	0.66	0.00	0.00	0.00	1.08
37.5	0.22	0.00	0.11	0.11	0.66	0.00	0.00	0.00	1.10
42.5	0.85	0.00	0.00	0.00	0.57	0.00	0.00	0.00	1.42
47.5	1.42	0.00	0.00	0.00	0.18	0.00	0.00	0.00	1.59
52.5	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30
57.5	3.38	0.00	0.00	0.00	0.78	0.00	0.00	0.00	4.15
62.5	3.68	0.00	0.00	0.00	0.31	0.00	0.00	0.00	3.99
67.5	4.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.65
72.5	4.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.95
77.5	3.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.30
82.5	4.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.81
87.5	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20
92.5	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67
97.5	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75
102.5	1.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.65
107.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
122.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
127.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
132.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
137.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
142.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
147.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	33.00	0.23	0.11	0.19	3.53	0.28	0.00	0.00	37.34

APPENDIX TABLE 4. Stand table before harvest by species and 5-cm diameter classes for Plot 4, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

A. Trees per hectare, Plot 4

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	2.0	7.0	0.0	0.0	5.0	8.0	0.0	0.0	22.0
27.5	3.0	1.0	0.0	0.0	3.0	0.0	2.0	0.0	9.0
32.5	1.0	2.0	0.0	0.0	3.0	1.0	0.0	0.0	7.0
37.5	2.0	1.0	0.0	1.0	8.0	1.0	0.0	0.0	13.0
42.5	7.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	9.0
47.5	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
52.5	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
57.5	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.0
62.5	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.0
67.5	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
72.5	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
77.5	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
82.5	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
87.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
92.5	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
97.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
102.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
107.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
112.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
117.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
122.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
127.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
132.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
137.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
142.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
147.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	117.0	11.0	0.0	1.0	21.0	10.0	2.0	0.0	162.0

APPENDIX TABLE 4, cont'd. Stand table before harvest by species and 5-cm diameter classes for Plot 4, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

B. Basal area per hectare, Plot 4

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	0.08	0.28	0.00	0.00	0.20	0.32	0.00	0.00	0.87
27.5	0.18	0.06	0.00	0.00	0.18	0.00	0.12	0.00	0.53
32.5	0.08	0.17	0.00	0.00	0.25	0.08	0.00	0.00	0.58
37.5	0.22	0.11	0.00	0.11	0.88	0.11	0.00	0.00	1.44
42.5	0.99	0.00	0.00	0.00	0.28	0.00	0.00	0.00	1.28
47.5	2.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.13
52.5	2.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.16
57.5	4.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.41
62.5	5.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.83
67.5	4.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.29
72.5	3.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.30
77.5	3.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.77
82.5	3.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.74
87.5	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60
92.5	2.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.69
97.5	2.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.24
102.5	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83
107.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
122.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
127.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
132.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
137.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
142.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
147.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	37.56	0.61	0.00	0.11	1.79	0.51	0.12	0.00	40.70

APPENDIX TABLE 5. Stand table before harvest by species and 5-cm diameter classes for Plot 5, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

A. Trees per hectare, Plot 5

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	7.0	0.0	0.0	2.0	0.0	13.0	5.0	0.0	27.0
27.5	6.0	0.0	0.0	2.0	7.0	2.0	3.0	0.0	20.0
32.5	6.0	0.0	0.0	5.0	3.0	0.0	1.0	0.0	15.0
37.5	5.0	0.0	0.0	1.0	6.0	1.0	0.0	0.0	13.0
42.5	9.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0	16.0
47.5	4.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	9.0
52.5	8.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0	15.0
57.5	9.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	13.0
62.5	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0
67.5	13.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	14.0
72.5	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
77.5	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
82.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
87.5	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
92.5	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
97.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
102.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
107.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
112.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
117.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
122.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
127.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
132.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
137.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
142.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
147.5	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0
TOTAL	106.0	0.0	0.0	11.0	40.0	16.0	9.0	0.0	182.0

APPENDIX TABLE 5, cont'd. Stand table before harvest by species and 5-cm diameter classes for Plot 5, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

B. Basal area per hectare, Plot 5

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	0.28	0.00	0.00	0.08	0.00	0.52	0.20	0.00	1.07
27.5	0.36	0.00	0.00	0.12	0.42	0.12	0.18	0.00	1.19
32.5	0.50	0.00	0.00	0.41	0.25	0.00	0.08	0.00	1.24
37.5	0.55	0.00	0.00	0.11	0.66	0.11	0.00	0.00	1.44
42.5	1.28	0.00	0.00	0.00	0.99	0.00	0.00	0.00	2.27
47.5	0.71	0.00	0.00	0.00	0.89	0.00	0.00	0.00	1.59
52.5	1.73	0.00	0.00	0.00	1.52	0.00	0.00	0.00	3.25
57.5	2.34	0.00	0.00	0.00	1.04	0.00	0.00	0.00	3.38
62.5	3.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.37
67.5	4.65	0.00	0.00	0.00	0.36	0.00	0.00	0.00	5.01
72.5	4.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.13
77.5	2.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.83
82.5	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60
87.5	2.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.41
92.5	1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.34
97.5	2.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.24
102.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
107.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
122.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
127.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
132.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
137.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
142.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
147.5	0.00	0.00	0.00	1.71	0.00	0.00	0.00	0.00	1.71
TOTAL	30.32	0.00	0.00	2.43	6.12	0.75	0.46	0.00	40.07

APPENDIX TABLE 6. Stand table before harvest by species and 5-cm diameter classes for Plot 6, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

A. Trees per hectare, Plot 6

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	1.0	3.0	0.0	0.0	9.0	5.0	0.0	0.0	18.0
27.5	5.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	11.0
32.5	2.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	8.0
37.5	6.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	8.0
42.5	7.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	8.0
47.5	2.0	2.0	0.0	0.0	1.0	0.0	0.0	0.0	5.0
52.5	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
57.5	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
62.5	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
67.5	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.0
72.5	17.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	18.0
77.5	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
82.5	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
87.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
92.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
97.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
102.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
107.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
112.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
117.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
122.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
127.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
132.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
137.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
142.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
147.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	103.0	6.0	0.0	0.0	25.0	5.0	0.0	0.0	139.0

APPENDIX TABLE 6, cont'd. Stand table before harvest by species and 5-cm diameter classes for Plot 6, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

B. Basal area per hectare, Plot 6

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	0.04	0.12	0.00	0.00	0.36	0.20	0.00	0.00	0.72
27.5	0.30	0.00	0.00	0.00	0.36	0.00	0.00	0.00	0.65
32.5	0.17	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.66
37.5	0.66	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.88
42.5	0.99	0.00	0.00	0.00	0.14	0.00	0.00	0.00	1.13
47.5	0.35	0.35	0.00	0.00	0.18	0.00	0.00	0.00	0.89
52.5	2.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.16
57.5	3.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.12
62.5	3.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.68
67.5	5.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.73
72.5	7.02	0.41	0.00	0.00	0.00	0.00	0.00	0.00	7.43
77.5	3.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.77
82.5	2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.14
87.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
92.5	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67
97.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
102.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
107.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
122.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
127.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
132.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
137.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
142.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
147.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	30.80	0.89	0.00	0.00	1.75	0.20	0.00	0.00	33.64

APPENDIX TABLE 7. Stand table before harvest by species and 5-cm diameter classes for Plot 7, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

A. Trees per hectare, Plot 7

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	7.0	1.0	0.0	0.0	10.0	1.0	0.0	0.0	19.0
27.5	3.0	3.0	0.0	0.0	1.0	0.0	0.0	0.0	7.0
32.5	4.0	3.0	0.0	0.0	3.0	0.0	0.0	0.0	10.0
37.5	7.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	9.0
42.5	4.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
47.5	6.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
52.5	17.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	19.0
57.5	20.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	22.0
62.5	16.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	19.0
67.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
72.5	11.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
77.5	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
82.5	3.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0
87.5	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
92.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0
97.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
102.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
107.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
112.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
117.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
122.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
127.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
132.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
137.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
142.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
147.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	119.0	21.0	1.0	0.0	15.0	1.0	0.0	0.0	157.0

APPENDIX TABLE 7, cont'd. Stand table before harvest by species and 5-cm diameter classes for Plot 7, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

B. Basal area per hectare, Plot 7

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	0.28	0.04	0.00	0.00	0.40	0.04	0.00	0.00	0.76
27.5	0.18	0.18	0.00	0.00	0.06	0.00	0.00	0.00	0.42
32.5	0.33	0.25	0.00	0.00	0.25	0.00	0.00	0.00	0.83
37.5	0.77	0.11	0.00	0.00	0.11	0.00	0.00	0.00	0.99
42.5	0.57	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.71
47.5	1.06	0.35	0.00	0.00	0.00	0.00	0.00	0.00	1.42
52.5	3.68	0.43	0.00	0.00	0.00	0.00	0.00	0.00	4.11
57.5	5.19	0.52	0.00	0.00	0.00	0.00	0.00	0.00	5.71
62.5	4.91	0.61	0.31	0.00	0.00	0.00	0.00	0.00	5.83
67.5	3.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.22
72.5	4.54	0.41	0.00	0.00	0.00	0.00	0.00	0.00	4.95
77.5	3.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.77
82.5	1.60	0.53	0.00	0.00	0.00	0.00	0.00	0.00	2.14
87.5	0.60	0.60	0.00	0.00	0.00	0.00	0.00	0.00	1.20
92.5	2.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.02
97.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
102.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
107.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112.5	0.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.99
117.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
122.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
127.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
132.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
137.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
142.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
147.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	32.73	5.18	0.31	0.00	0.82	0.04	0.00	0.00	39.08

APPENDIX TABLE 8. Stand table before harvest by species and 5-cm diameter classes for Plot 8, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

A. Trees per hectare, Plot 8

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	12.0	13.0	0.0	0.0	10.0	4.0	0.0	0.0	39.0
27.5	7.0	3.0	0.0	0.0	5.0	0.0	0.0	0.0	15.0
32.5	4.0	4.0	0.0	1.0	2.0	0.0	0.0	0.0	11.0
37.5	4.0	4.0	0.0	0.0	3.0	0.0	0.0	0.0	11.0
42.5	10.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0
47.5	10.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	11.0
52.5	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
57.5	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
62.5	18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.0
67.5	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0
72.5	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
77.5	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0
82.5	5.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0
87.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
92.5	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0
97.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
102.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
107.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
112.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
117.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
122.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
127.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
132.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
137.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
142.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
147.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	123.0	28.0	1.0	1.0	20.0	4.0	0.0	0.0	177.0

APPENDIX TABLE 8, cont'd. Stand table before harvest by species and 5-cm diameter classes for Plot 8, Carrillo study area, CEF San Juan Tetla. Data based on 100 percent inventory of the 1.0-ha measurement plot. DCL5CM represents 5-cm diameter classes, where any given x.5 DCL5CM ranges from (x-2).0 cm to (x+2).9 cm.

B. Basal area per hectare, Plot 8

DBH5CM	P.montezumae	P.ayacahuite	P.teocote	A.religiosa	A.firmifolia	S.oxylepis	Salix sp.	Quercus sp.	All sp.
22.5	0.48	0.52	0.00	0.00	0.40	0.16	0.00	0.00	1.55
27.5	0.42	0.18	0.00	0.00	0.30	0.00	0.00	0.00	0.89
32.5	0.33	0.33	0.00	0.08	0.17	0.00	0.00	0.00	0.91
37.5	0.44	0.44	0.00	0.00	0.33	0.00	0.00	0.00	1.21
42.5	1.42	0.14	0.00	0.00	0.00	0.00	0.00	0.00	1.56
47.5	1.77	0.00	0.18	0.00	0.00	0.00	0.00	0.00	1.95
52.5	1.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.73
57.5	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.60
62.5	5.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.52
67.5	4.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.65
72.5	4.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.95
77.5	3.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.77
82.5	2.67	0.53	0.00	0.00	0.00	0.00	0.00	0.00	3.21
87.5	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.60
92.5	0.67	0.67	0.00	0.00	0.00	0.00	0.00	0.00	1.34
97.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
102.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
107.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
112.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
117.5	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.08
122.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
127.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
132.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
137.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
142.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
147.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	32.52	3.42	0.18	0.08	1.19	0.16	0.00	0.00	37.55

FIGURE A1. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 1, CEF San Juan Tetla study area. Data based on 100% inventory of 1.0-ha measurement plot. Filename: SJTDD.WB1.

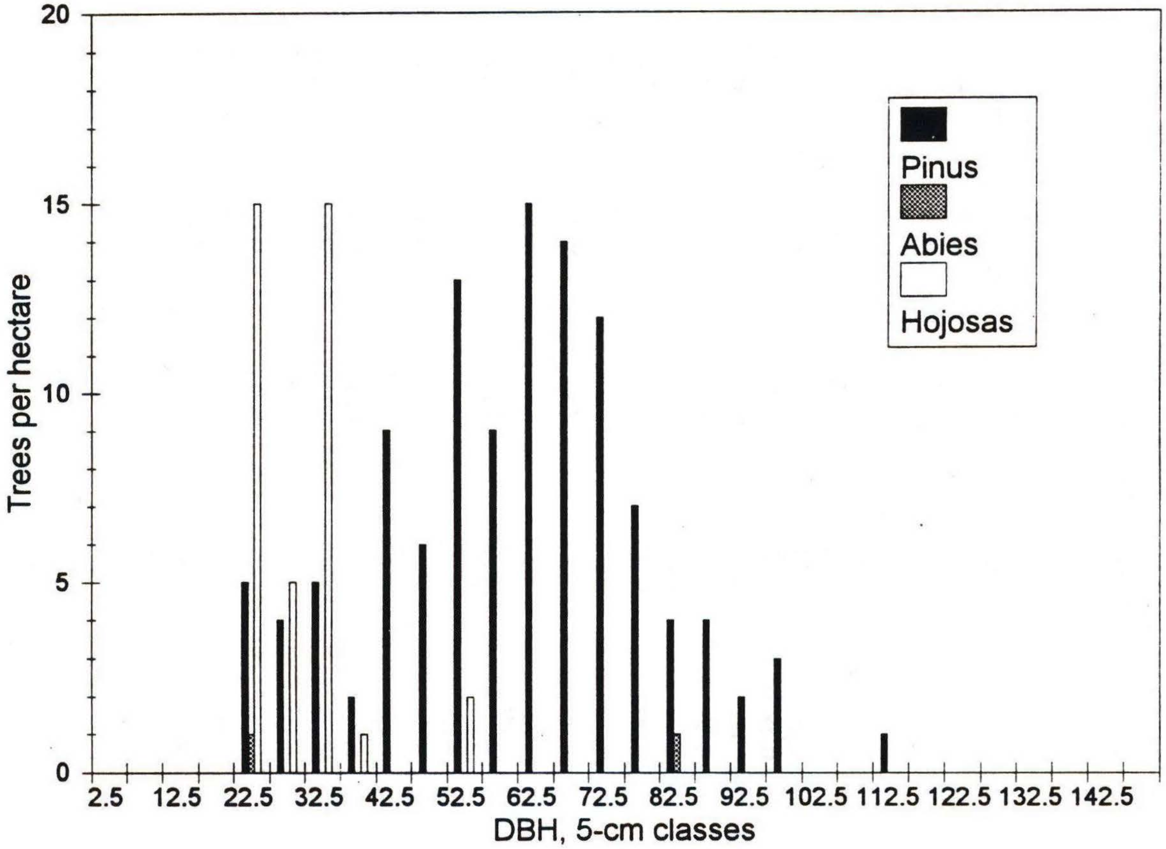


FIGURE A2. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 2, CEF San Juan Tetla study area. Data based on 100% inventory of 1.0-ha measurement plot. Filename: SJTDD.WB1.

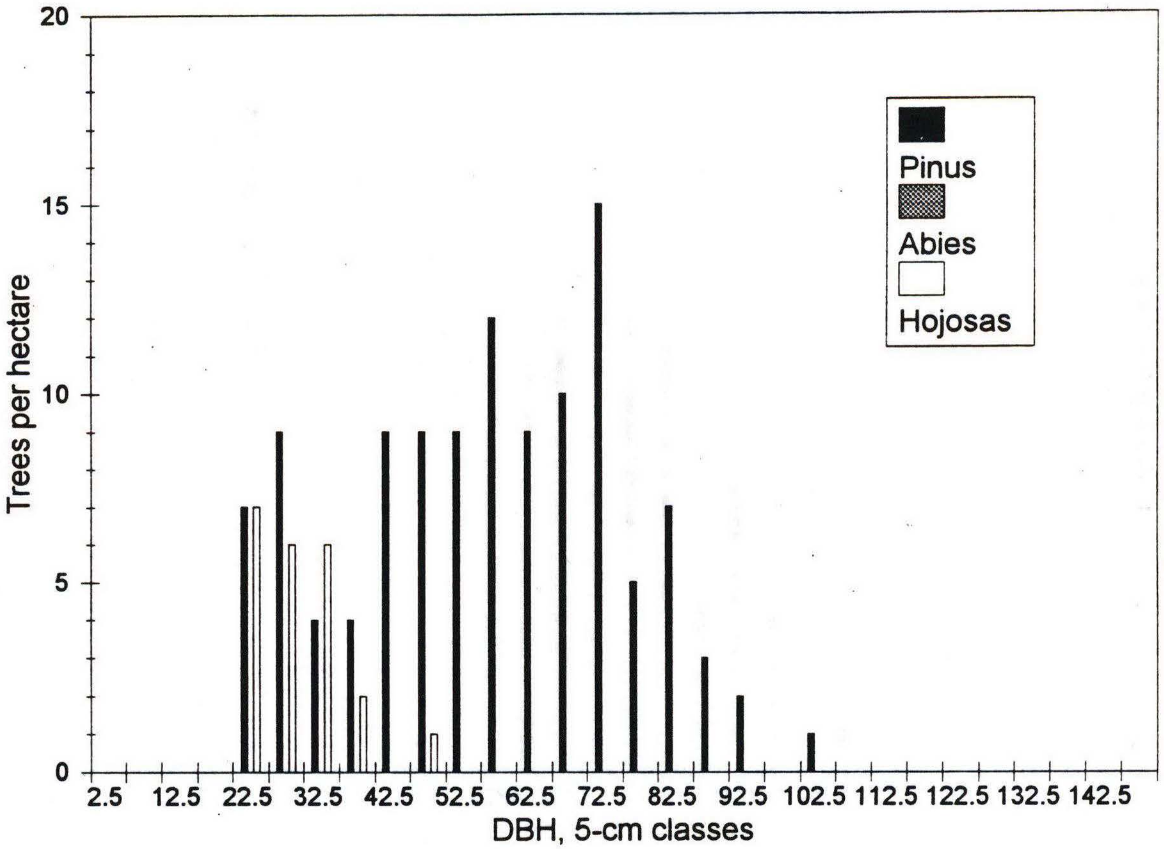


FIGURE A3. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 3, CEF San Juan Tetla study area. Data based on 100% inventory of 1.0-ha measurement plot. Filename: SJTDD.WB1.

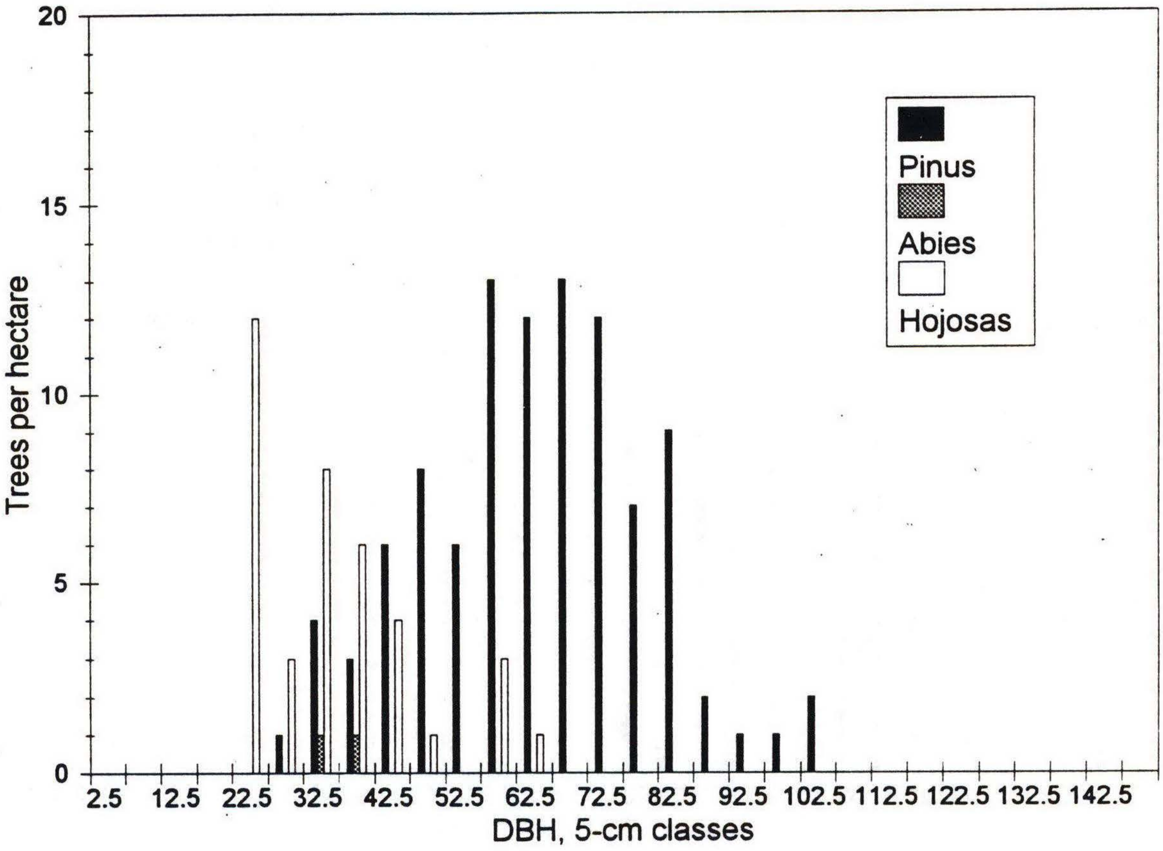


FIGURE A4. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 4, CEF San Juan Tetla study area. Data based on 100% inventory of 1.0-ha measurement plot. Filename: SJTDD.WB1.

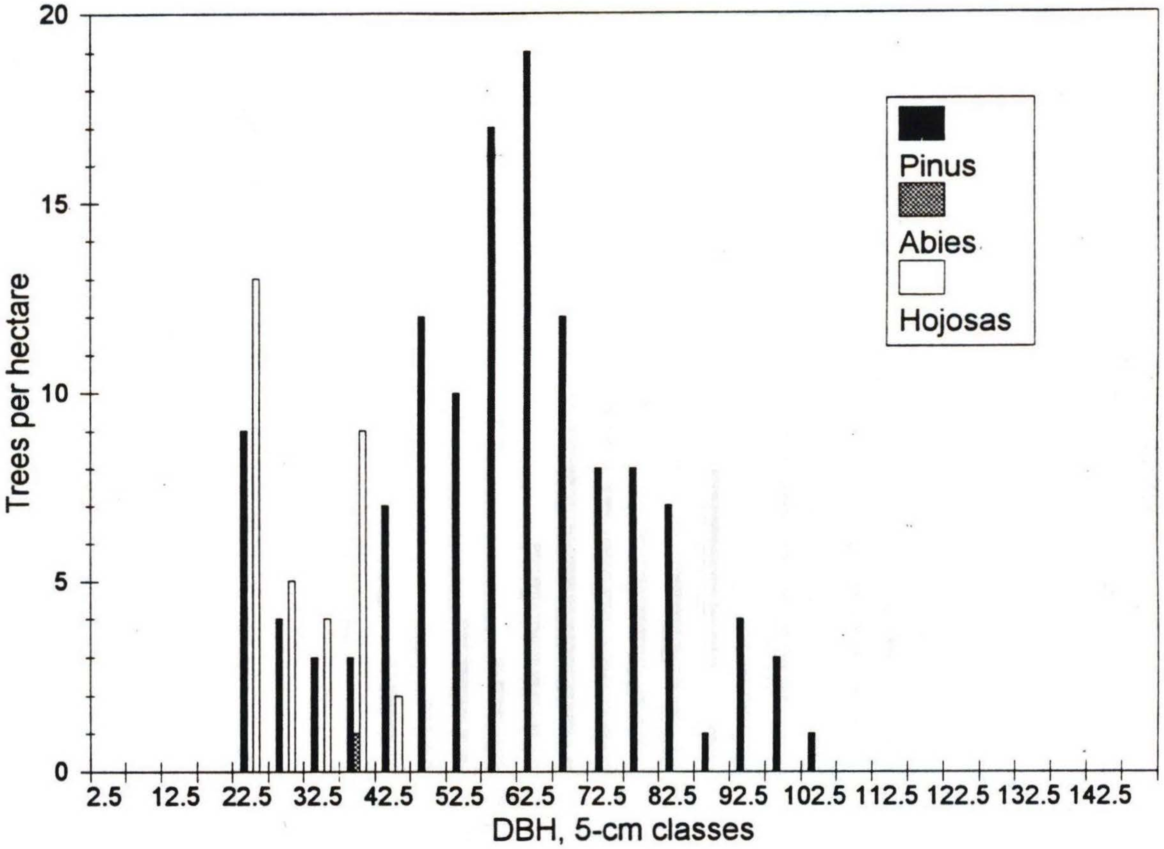


FIGURE A5. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 5, CEF San Juan Tetla study area. Data based on 100% inventory of 1.0-ha measurement plot. Filename: SJTDD.WB1.

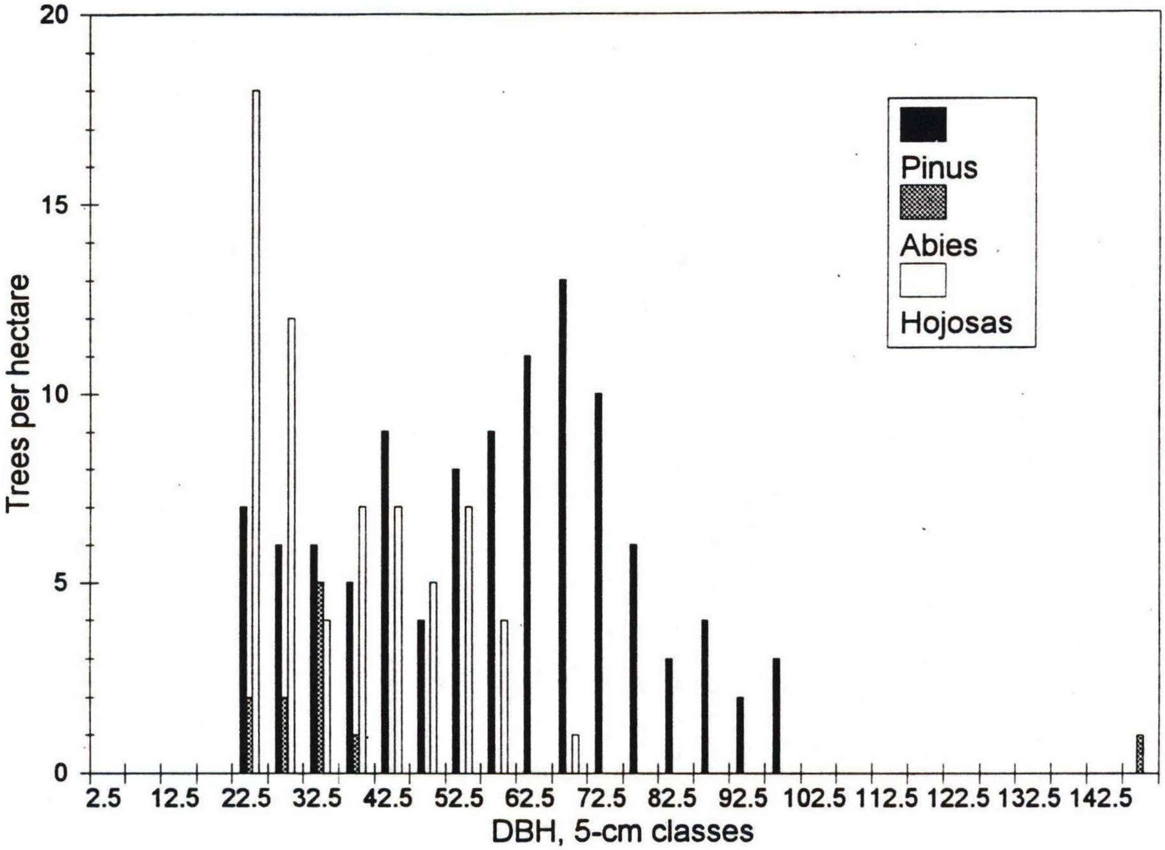


FIGURE A6. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 6, CEF San Juan Tetla study area. Data based on 100% inventory of 1.0-ha measurement plot. Filename: SJTDD.WB1.

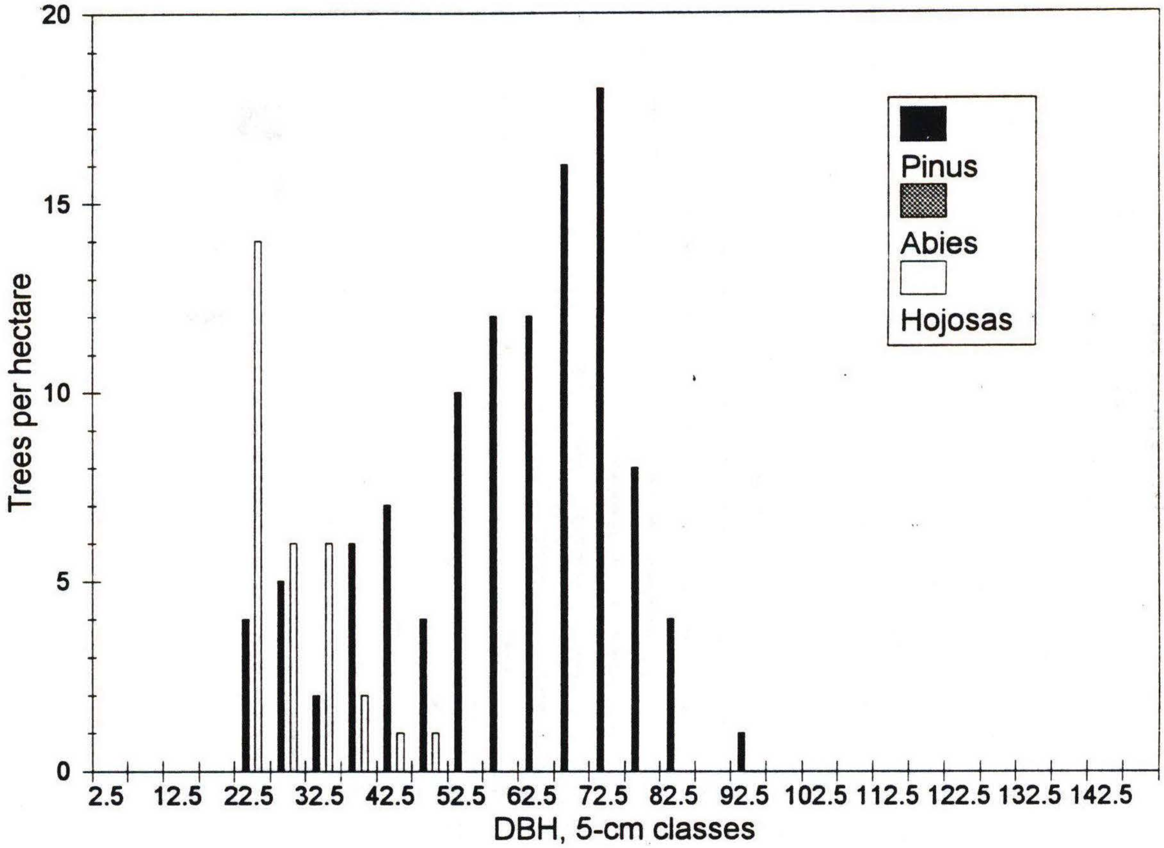


FIGURE A7. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 7, CEF San Juan Tetla study area. Data based on 100% inventory of 1.0-ha measurement plot. Filename: SJTDD.WB1.

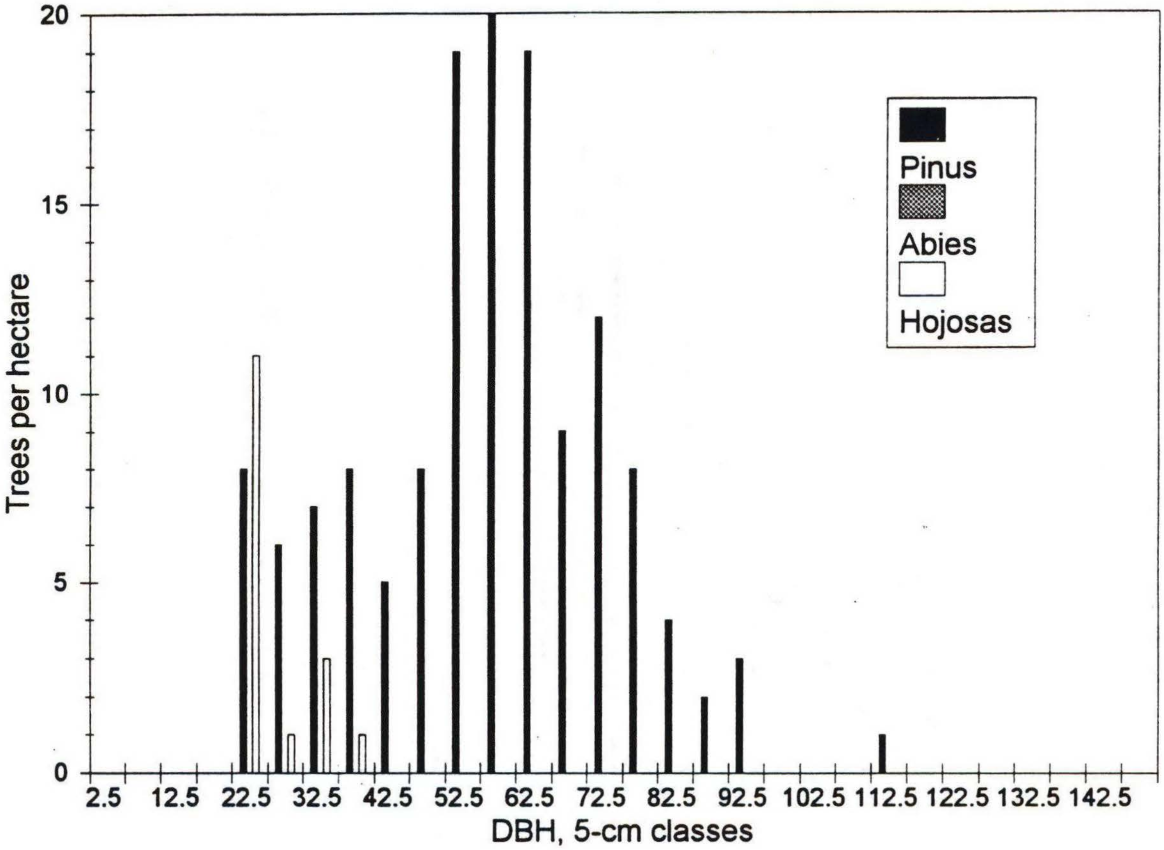


FIGURE A8. Diameter distribution before harvest (trees per hectare x 5-cm diameter classes) of Pinus, Abies, and hardwoods (hojosas) for Plot 8, CEF San Juan Tetla study area. Data based on 100% inventory of 1.0-ha measurement plot. Filename: SJTDD.WB1.